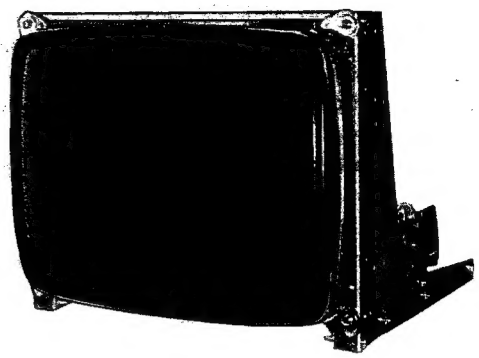
ORDER NO. FTD86095095C2

Service Manual

Color CRT Display

MODEL TX-1413FHE

Chassis No. X13



CONTENTS

Panasonic®

Matsushita Electric Trading Co., Ltd.
P.O. Box 288, Central Osaka Japan

SAFETY PRECAUTIONS

1 CAUTION

No modification of any circuit should be attempted. Service work should only be performed after you are thoroughly familiar with all of the following safety checks and servicing guide lines.

2 SAFETY CHECK

Care should be taken while servicing this CRT display because of the high voltage used in the deflection circuits. These voltages are exposed in such areas as the associated flyback and yoke circuits.

3 FIRE & SHOCK HAZARD

3-1 Insert an isolation transformer between the CRT display and AC power line before servicing chassis.

3-2 In servicing pay attention to original lead dress especially in the high voltage circuit. If a short circuit is found, replace all parts which have been overheated as a result of the short circuit.

3-3 All the protective devices must be reinstalled per original design.

3-4 Soldering must be inspected for possibly cold solder joints, frayed leads, damaged insulation, solder splashes or sharp solder points. Be certain to remove all foreign material.

4 LEAKAGE CURRENT COLD CHECK

4-1 Unplug the AC cord and connect a jumper between the two prongs on the plug.

4-2 Turn the CRT display power switch on.

4-3 Measure the resistance value with an ohmmeter between the jumpered AC plug and each exposed metallic part on the CRT display such as metal frame screwhead, control shafts, etc. When the exposed metallic part has a return path to the chassis, the reading should be 1.8 megohm minimum.

5 LEAKAGE CURRENT HOT CHECK

5-1 Plug the AC cord directly into the AC outlet. Do not use an isolation transformer during this check.

5-2 Connect a 1500 ohm, 10 watt resistor, paralleled by a 0.15μF capacitor between each exposed metallic part and good earth ground (as shown in Fig. 1).

5-3 Use an AC voltmeter with 1000 ohm/volt or more sensitivity and measure the AC voltage across the combination 1500 ohm resistor and 0.15μF capacitor.

5-4 Move the resistor connection to each exposed metallic part and measure the voltage.

5-5 Reverse the polarity of the AC plug in the AC outlet and repeat the above measurement.

5-6 Voltage measured must not exceed 7.5 volt RMS, from any exposed metallic part to ground.

A leakge current tester may be used in the above hot check, in which case any current measured must not exceed 5.0 milliamp. In the case of a measurement exceeding the 5.0 milliamp value, a rework is required to eliminate the chance of a shock hazard.

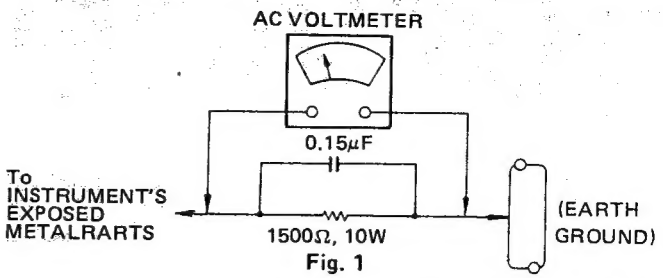


Fig. 1

Note: High voltage is present when this CRT display is operating. Always discharge the anode of the picture tube to the display chassis to prevent shock hazard.

6 IMPLOSION PROTECTION

All Panasonic picture tubes are equipped with an integral implosion protection system, but care should be taken to avoid damage and scratching during installation.

Use only Panasonic replacement picture tubes.

7 X-RADIATION

WARNING: The only potential source of X-Radiation is the picture tube. However when the high voltage circuitry is operating properly there is no possibility of X-Radiation problem. The basic precaution which must be exercised is to keep the high voltage at the following factory-recommended level.

Note: It is important to use an accurate periodically calibrated high voltage meter.

7-1 To measure the high voltage, use a high impedance high voltage meter, connect (−) to the external conductive coating (aquadag) of CRT and (+) to the CRT anode button.

7-2 Turn the Brightness control fully counterclockwise.

7-3 Measure the high voltage. The high voltage meter should indicate at the following factory-recommended level.

7-4 If the upper meter indication exceeds the maximum level, immediate service is required to prevent the possibility of premature component failure.

7-5 To prevent X-Radiation possibility, it is essential to use the specified picture tube.

7-6 The nominal high voltage is 24kV and must not exceed 28kV at zero beam current at rated voltage.

IMPORTANT SAFETY NOTICE

There are special components used in this CRT Display which are important for safety.

These parts are identified by the international symbol ⚠ on the schematic diagram and on the replacement parts list. It is essential that these critial parts should be replaced with manufacture's specified parts to prevent X-RADIATION, shock, fire or other hazards.

Do not modify the original design without written permission of the Matsushita Electric or this will void the original parts and labor guarantee.

GENERAL INFORMATION

- Here is an outline of model TX-1413FHE.
- This model is COLOR CRT DISPLAY of metal frame type.
- TX-1413FHE uses high resolution (Dot pitch 0.31mm) R.G.B. short persistence Color Cathode Ray Tube.
- The input signals are separate type and each is applied through the 9 pin D-subminiature connector.
- Input signals are TTL level.
- TX-1413FHE can display up to 16 colors including black.
- A switching regurator circuit is applied to the power supply of this model. It is available for AC input 198 ~ 264V.
- In order to meet users' requirements, frame mechanisum is employed for easy adjustment of CRT setting angle.
- Angle can be changed by stages such as 0°, 2.5°, 7.5° and 10°.

SPECIFICATIONS

1. MECHANICAL DESCRIPTION

Dimension
- Height: 287 mm typ.
- Width: 330 mm typ.
- Depth: 370 mm typ.
- Weight: 10 kg

Cathod-Ray Tube: 370MYB22N
- Size 14"
- Gun In – Line
- Def. Angle 90°
- Neck dia. 29 mm
- Phosphor P22 (R.G.B)
- Faceplate Dark Body, Direct Etch.

Tilt: 0°

2. ENVIRONMENT

Ambient temp, Humidity and Altitude:

Operating
- Temp: 0° ~ 50°C
- Humidity: 5 ~ 90%
- Altitude: 10,000 FT max. (3,000m)

Non-operating
- Temp: –40° ~ 65°C
- Humidity: 5 ~ 90%
- Altitude: 40,000 FT max. (12,000m)

Storage and Shipment
- Temp: –40° ~ 65°C
- Humidity: 5 ~ 90%
- Altitude: 40,000 FT max. (12,000m)

Vibration and Shock (Packaged condition)

Vibration:
- Frequency: 5 ~ 55 Hz
- Vertical: 1.25 G
- Horizontal: 0.75 G

Shock:
- Corner and Edge: Height 40 cm
- Front, Back, Side and Bottom: Height 50 cm

3. ELECTRIC PERFORMANCE

Power supply
- Input Voltage: AC198 ~ 264V
- Input Frequency: 48 to 62 Hz
- Input Current: 0.5A max. (at 220V AC)
- Power: 60W max.
- Inrush Current: 60Ao-p max. (at 220V AC)

Input Signals

Horizontal Sync:
- Polarity: Positive
- Signal Level: 4Vp-p ±1V
- Input Imp.: 1K ohms

Vertical Sync:
- Polarity: Positive
- Signal Level: 4Vp-p ±1V
- Input Imp.: 1K ohms

Video Signal (R.G.B.I): (See Note 1)
- Polarity: Positive
- Signal Level: 4Vp-p (See Note 2)
- Tr, Tf: ≦10nS

Note 1. Max rise and fall times (from 10% to 90%) of input signals are less than 10nS.

Note 2. Color Function Table (16 colors)

16 colors					Output level			Color name	Cont.	Bright
No.	I	R	G	B	R %	G %	B %			
1	0	0	0	0	0	0	0	Black	X	O
2	0	0	0	1	0	0	66	Blue	O	O
3	0	0	1	0	0	66	0	Green	O	O
4	0	0	1	1	0	66	66	Cyan	O	O
5	0	1	0	0	66	0	0	Red	O	O
6	0	1	0	1	66	0	66	Magenta	O	O
7	0	1	1	0	66	66	0	Yellow	O	O
8	0	1	1	1	66	66	66	Light gray	O	O
9	1	0	0	0	33	33	33	Dark Gray	X	O
10	1	0	0	1	33	33	100	Light Blue	X	O
11	1	0	1	0	33	100	33	Light Green	X	O
12	1	0	1	1	33	100	100	Light Cyan	X	O
13	1	1	0	0	100	33	33	Light Red	X	O
14	1	1	0	1	100	33	100	Light Magneta	X	O
15	1	1	1	0	100	100	33	Light Yellow	X	O
16	1	1	1	1	100	100	100	White	X	O

Image test Condition
- Character: "H"
- Color: Green
- Brightness: Max. (without Background)
- View Direction: Parallel to the CRT axis
- Ambient Temperature: Room Temperature
- Supply Voltage: AC220V

Note 3. Measure more than 20 minuts after power on.

Note 4. Normal condition is the condition that satisfies image test condition. (Condition of following items is normal condition, if not mentioned).

Video Out

Turn Rise Time (Tr): Less than 40nS

Turn Fall Time (Tf): Less than 40nS

(Measured with 10MHz square-wave Duty 50%).

Image

Character Area:

Horizontal: 240 ± 5 mm

Vertical: 180 ± 5 mm

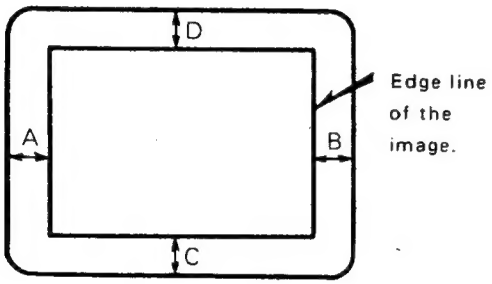
Normal Condition

IMAGE POSITION:

Image position is adjustable at the center of the CRT to the dimensions below.

To be able to adjust at center of the CRT.

Image is within the area in Figure.



|A−B| ≦ 6 mm

|C−D| ≦ 6 mm

Normal Condition

DISTORTION:

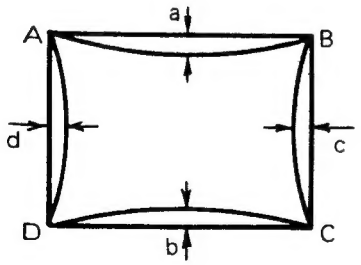
(A) PINCUSHION

Upper: (a): Less than 2.5 mm

Lower: (b): Less than 2.5 mm

Right and Left (c), (d):

Less than 2.5 mm

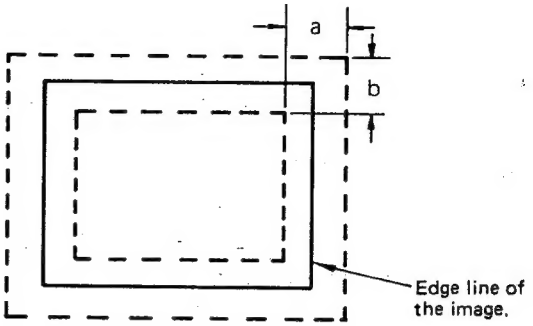


Input signal.....Cross-hatch

Normal Condition

(B) RECTANGULARNESS & PARALLELOGRAM DISTORTION

Edge of the image is within the area indicated by the dotted line in Figure.



a..... 4 mm

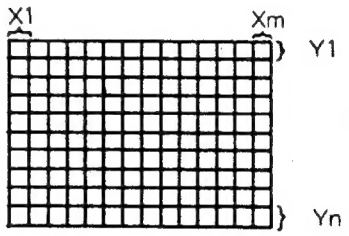
b..... 4 mm

Input signal.....Cross-hatch

Normal Condition

(C) LINEARITY

Horizontal and vertical linearity shall be less than 7% see Figure.



Horizontal linearity

$$\frac{X\ max - X\ min}{X\ max + X\ min} \times 100(\%) \leqq 7\%$$

Vertical linearity

$$\frac{Y\ max - Y\ min}{Y\ max + Y\ min} \times 100(\%) \leqq 7\%$$

Note: Maximum and minimum value should not be adjacent to each other.

X max is maximum value among X1~Xm.

X min is minimum value among X1~Xm.

Y max is maximum value among Y1~Yn.

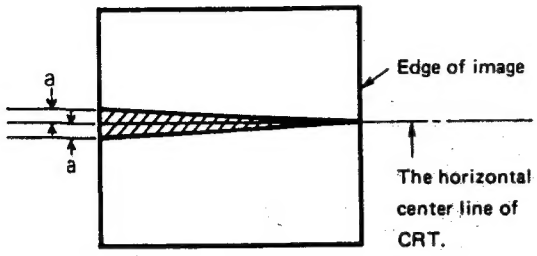
Y min is minimum value among Y1~Yn.

Input signal.... Cross-hatch.

Normal Condition

(D) ROTATION

Horizontal center line of the image shall be within the shaded area in Figure.



a..... 2.5 mm
Input signal.....Cross-hatch, Green.
Normal Condition

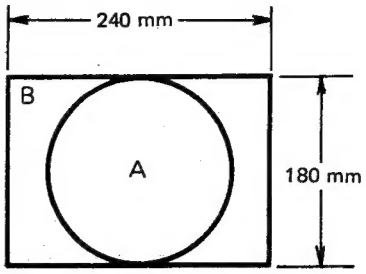
IMAGE SIZE VARIATION:

Cause	Image size variation from the normal image size.	Range of Variation
By Brightness	Within ± 4 mm (Horizontal and Vertical)	Max. to Min.
By Power Supply Voltage	Within ± 4 mm (Horizontal and Vertical)	AC198 ~ 264V
By temperature	Within ± 4mm (Horizontal and Vertical)	20±20°C

Normal condition, if not mentioned.

OVERALL PERFORMANCE:

(A) MIS-CONVERGENCE



Center of the display area
A ≦ 0.6 mm
Peripheral display area
B ≦ 0.8 mm

Note: Should be measured under the following conditions.
*Without horizontal magnetic field.(terrestrial).
*with vertical magnetic field.
*At room temperature.
*Input signal : Cross-hatch, R.G.B. mixed color.

(B) RESOLUTION

Horizontal : 810 pixels
Vertical : 670 pixels

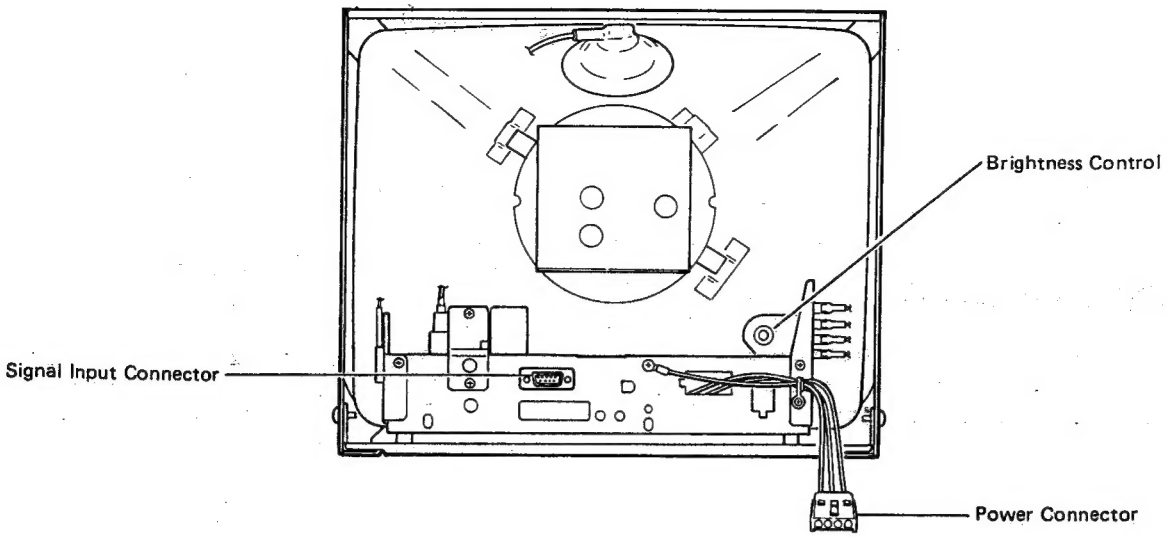
INSULATION:

More than 100MΩ
(Between AC line and Chassis)

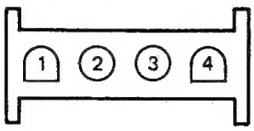
JITTER:

Less than 1 dot.
Invisible at a distance of 45 cm from CRT surface.

CONNECTOR AND WIRING



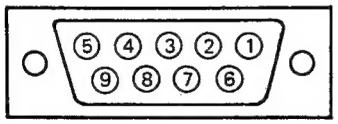
Power Connector



Pin No.	Description
1	AC (live)
2	No Connection
3	AC (neutral)
4	Frame Ground

Display Side	Customer Side
4-pole cap-housing: 350780-1	Connector: 350779-1
Pin contact: 350561-1	Contact: 350570-1
Maker: AMP Universal Mate-N-lock connector	

Signal Input Connector



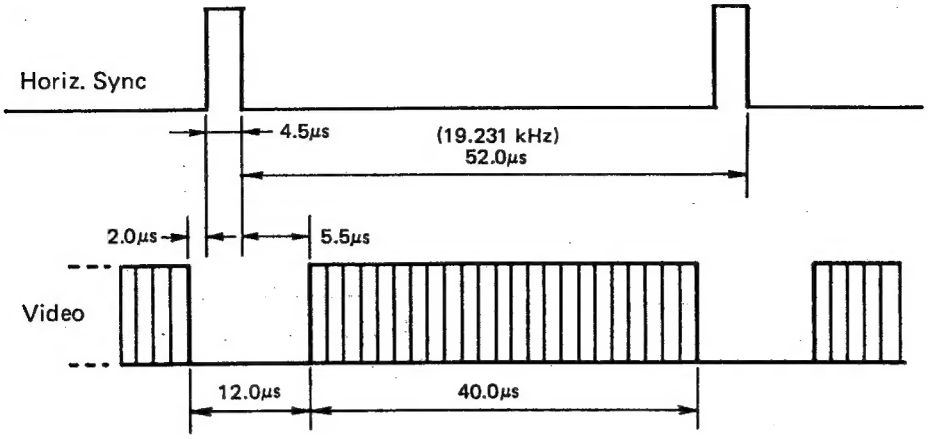
JEA 9-Pin D-subminiature Connector

Pin No.	Description
1	Signal ground
2	No Connection
3	Video (Red)
4	Video (Green)
5	Video (Blue)
6	Intensity
7	No Connection
8	H. SYNC
9	V. SYNC

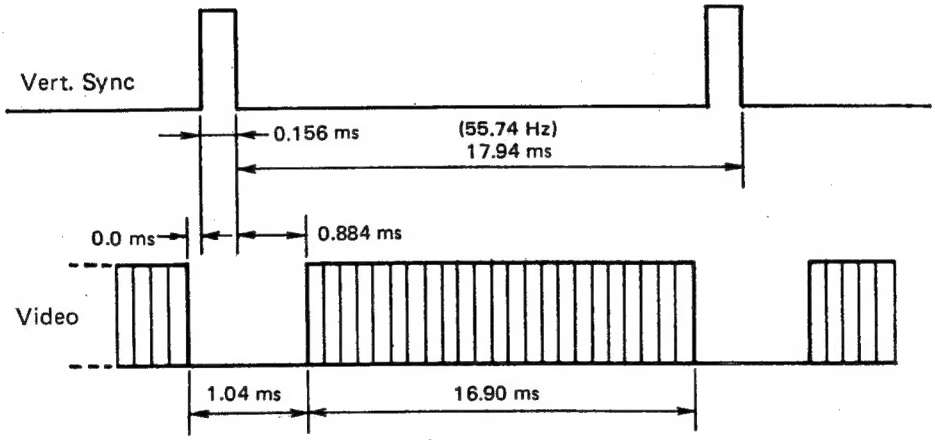
Note: The connectors of customer side are for your referance.

TIMING CHART

HORIZONTAL



VERTICAL



Note:

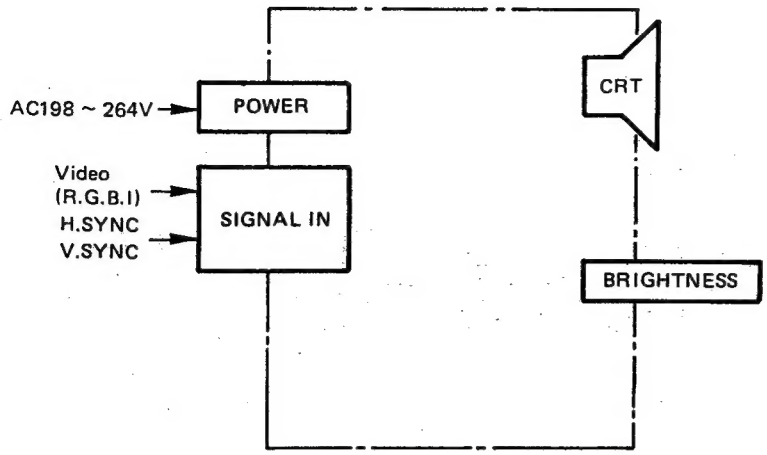
Pixel Period:	55.6ns
Pixel rate:	18.000MHz
Signal Input level:	TTL level
Time tolerance:	± 0.1%
Scanning mode:	Non-interlaced

Unit is adjusted according to this timing and frequency.

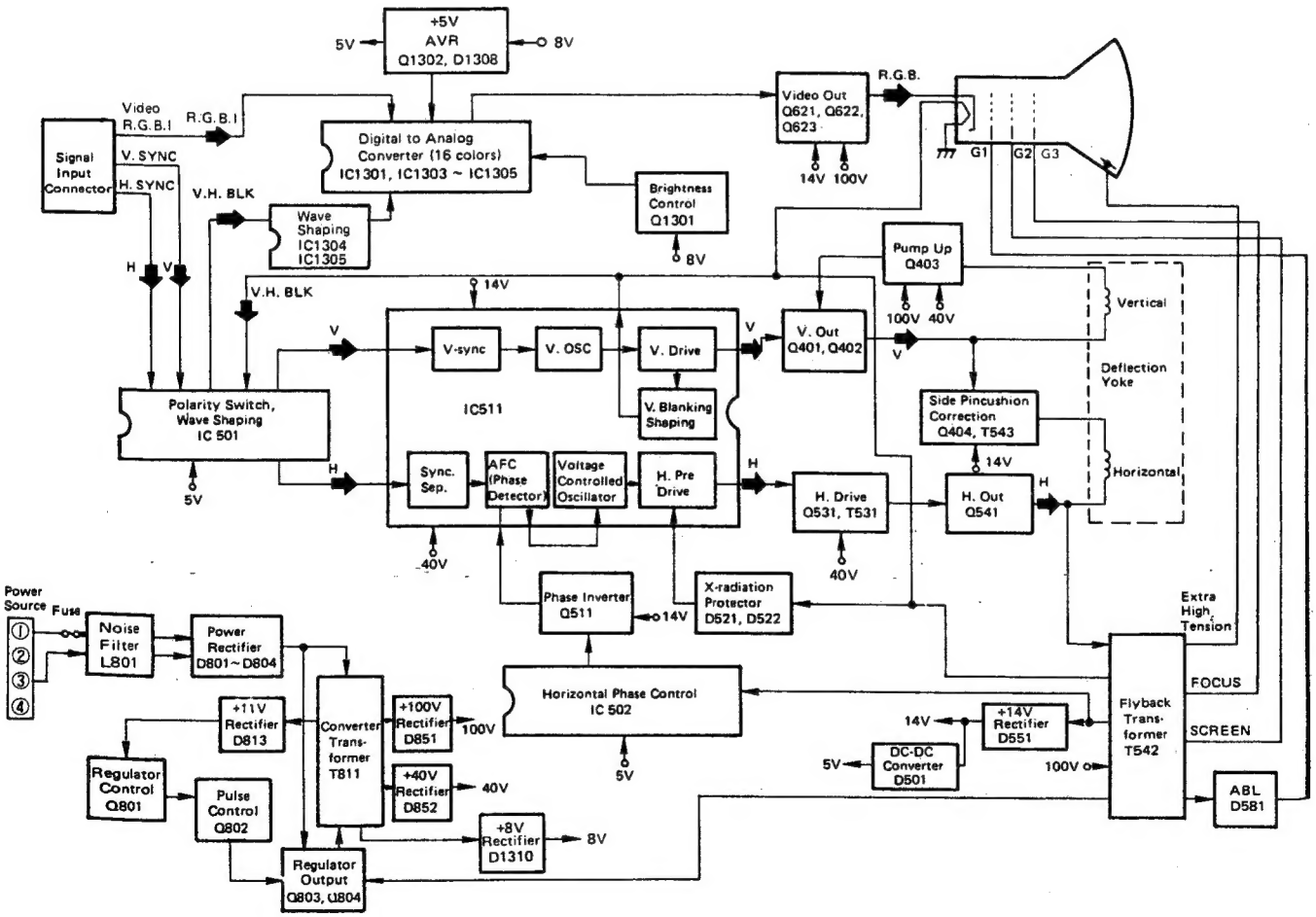
CONSTRUCTION AND BLOCK DIAGRAM

CONSTRUCTION OUTLINE

Note 1: CRT's Conducting Film (aquadag) is Connected to SG. (Signal Ground)

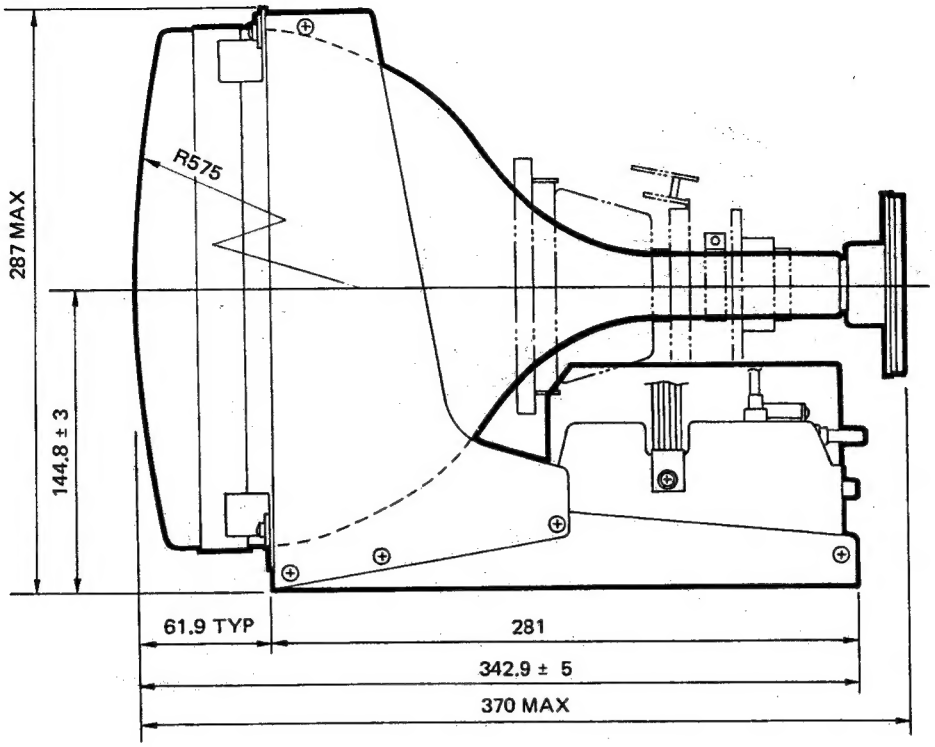


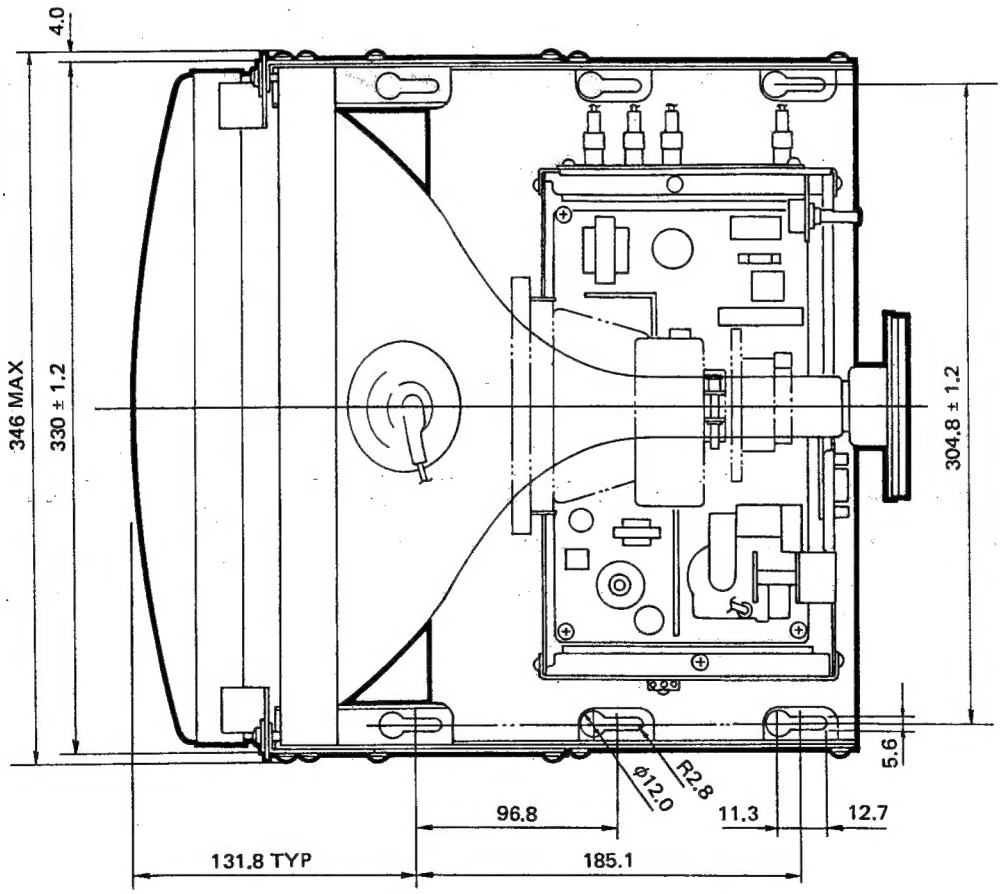
BLOCK DIAGRAM



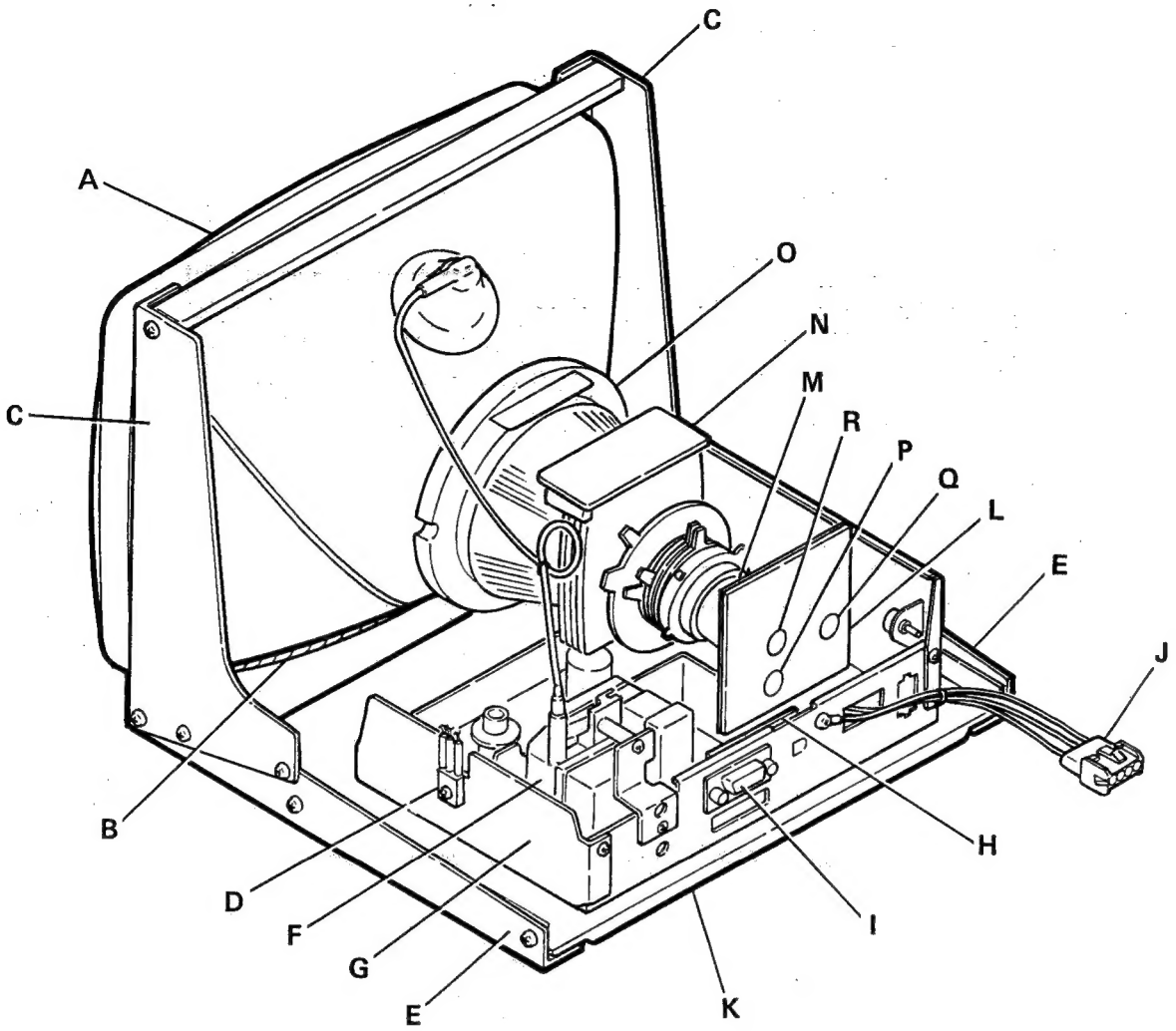
DIMENSIONS

: mm



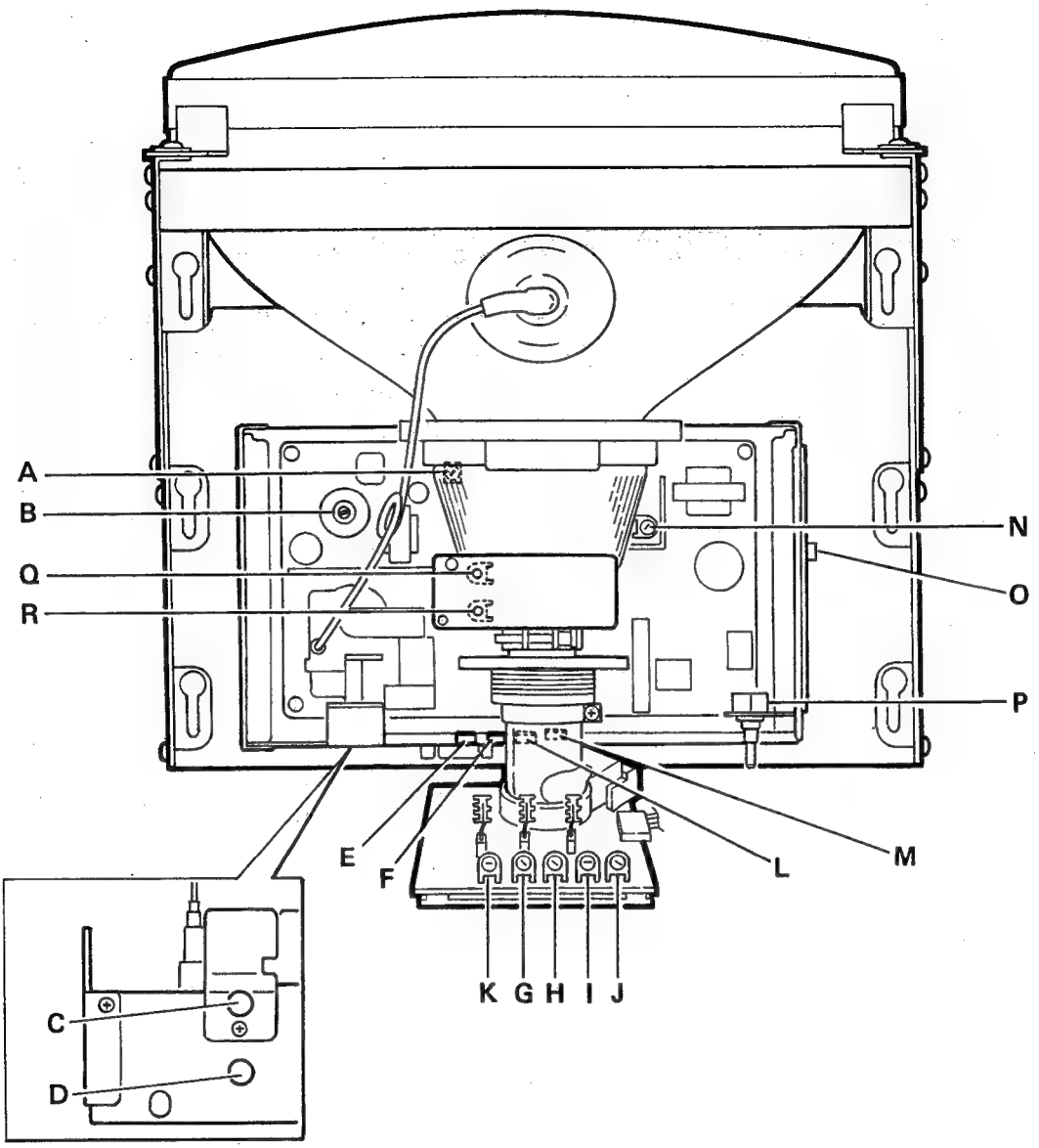


COMPONENT LOCATION



A . . . CRT
B . . . Degaussing Coil
C . . . Side Plate (Right and Left)
D . . . H. OUT TR (Q541)
E . . . Side Bracket (Right and Left)
F . . . FBT
G . . . Heat Sink
H . . . Signal P.C.Board
I . . . Signal Input Connector
J . . . Power Connector
K . . . Bottom Plate
L . . . Shield Plate
M . . . CRT P.C.Board
N . . . DY P.C.Board
O . . . Deflection Yoke
P . . . TP66 (Ground)
Q . . . TP87 (100V)
R . . . TP65 (G2)

CONTROL LOCATION



A . . . Sub H.P.C (VR502)
B . . . Width (L542)
C . . . Focus
D . . . Screen
E . . . V. Center (VR403)
F . . . Height (VR402)
G . . . Red Drive (VR621)
H . . . Red Low (VR631)
I . . . Blue Drive (VR623)
J . . . Blue Low (VR633)
K . . . Green Low (VR632)
L . . . V. Hold (VR401)
M . . . H.Hold (VR511)
N . . . AVR (VR811)
O . . . Sub Bright (VR1301)
P . . . Bright (VR501)
Q . . . TILT (Convergence Potentiometer) (VR52B)
R . . . AMP (Convergence Potentiometer) (VR51B)

CAUTION FOR ADJUSTMENT AND REPAIR

1. Degaussing is inevifably required at purity adjustment or convergence adjustment.
2. At the factory a white balance meter is used. In this manual a simplified method is given.
3. If you check or adjust electrical specification or function, more than 20 minutes burn-in is required.
4. Observe proper lead dress when reassembling the unit.

CAUTION FOR SERVICING

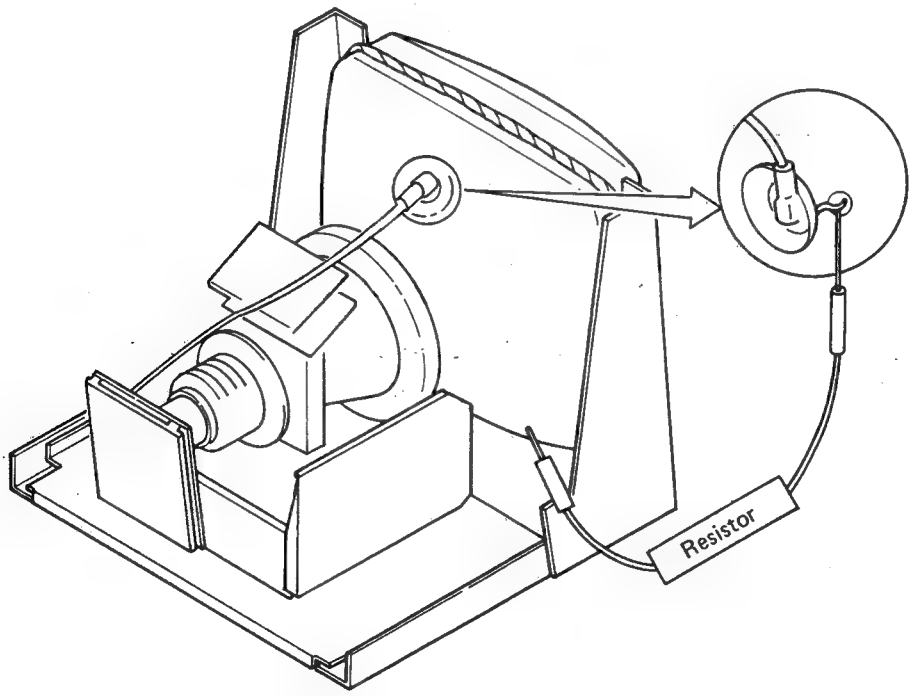
In case of servicing or replacing CRT, high Voltage sometimes remains in the anode of CRT, So, completely discharge high voltage before servicing or replacing CRT so as to prevert a shock to the serviceman.

CRT Anode Discharge

1. When you check the CRT anode or replace CRT, discharge the CRT anode to the external conductive coating (aquadag) of CRT, especially when checked right after power turn-off.
2. Ground one end of a jumper wire which has a resistor (30kV < resisting pressure 100MΩ) and connect the other point to the CRT anode.
   NOTE: Grounding must be done first.

This model has a section that does not share a common ground with the power supply section. The different sections are referred to as the HOT section and the COLD section in the precautions below.

1. Do not touch the HOT section and the COLD section at the same time. You may receive an electric shock.
2. Do not short the HOT section to the COLD section. This could blow the fuse or even damage parts.
3. Never measure the HOT section and the COLD section at the same time when using tools such as oscilloscopes or multimeters.
4. Always unplug the unit before beginning any operation such as removing the chassis.



ADJUSTMENT PROCEDURE

1. +B Voltage adjustment

Adjust the VR811 (AVR) so as that the voltage at TP85 (test point of main P.W.A) or TP87 (test point of CRT P.W.A) shall be 100V.

2. Purity adjustment

- If partial color phase irregularity is found on the screen, make the following adjustment.
  (1) Degauss the magnetism of chassis and CRT with external degaussing coil.
  (2) Adjust the purity magnet until each of the red, green and blue channels is free of color phase irregularity.
- If partial color phase irregularity cannot be corrected by the above when the CRT or deflection yoke has been replaced, make the following adjustment.
  (1) Make sure that this adjustment is done later than 30 minutes after power on.
  (2) Degauss the magnetism of chassis and CRT with degaussing coil.
  (3) Confirm that static convergence is roughly matched.
  (4) Remove the wedge stopper from the deflection yoke, and pull the deflection yoke fully to the front.
  (5) Display green color solely with the signal generator.
  (6) Adjust the purity magnet so that the center of the screen displays a pure green disk.
  (7) After the adjustment of step 6, re-adjust the static convergence if some gap was found.
  (8) After the item 7, repeat the step 6 again.
  (9) Display red and blue disks. Adjust the purity magnets so as that each disk is at the center of the screen simultaneously.
  (10) Slide the deflection yoke rearward until the screen appears green on the whole, and fasten it there. (Fasten in a forward position with ample allowance for landing).
  (11) Confirm purity in each direction by rotating the set to direction of East, West, South and North after demagnetize by external degaussing coil.
  (12) If magnetism remains even after the adjustment, use the compensation magnet to obtain purity.

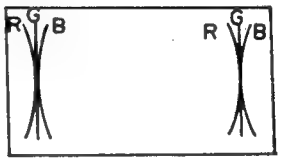
The final confirmation method for purity

In the natural magnetic field, rotate the monitor in the direction of East, West, South and North. Earth's magnetic field may cause magnetism on the monitor. Confirm that the automatic degaussing circuit built in the monitor erase the amount of magnetism which was introduced with above rotation.

The degaussing circuit operates only when the monitor is cold, you must wait for the monitor to cool after each purity test.

3. Convergence adjustment

1) Input the mixed cross-hatch pattern of R and B with the signal generator.
2) Match the R and B at screen center with four pole magnet. (Rotate the two ring magnets and R.B. move circularly with the other direction respectively.)
3) Input the mixed cross-hatch pattern of R.G.B. with the signal generator.
4) At the screen center, match R and B to G with the six-pole magnet.
5) Make the fine tuning of D.Y. location so as to get good convergence on the whole screen.
6) Adjust the convergence of the fringe area (four corners), using VR451B and VR452B.



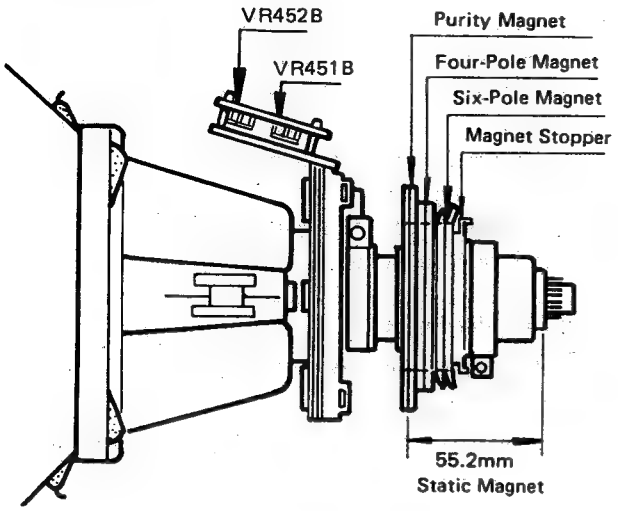
If the convergence on the fringe area is bad, put "the magnetic small pieces" at the four corners of D.Y. and fix them so the convergence becomes better.

Note: Caution for putting "the magnetic small pieces".
(1) Take more than 20mm distance from anode cap.
(2) Don't put them together.
(3) Don't put it on some other labels.

7) After the convergence adjustment, confirm if purity is OK.

In case purity is no good, back to [2] purity adjustment and re-adjust the purity.

8) Repeat the above procedure in several times to get the best purity and convergence.



4. H. Width adjustment

Adjust L542 (Width) so the width is 240mm.

5. Height adjustment

Adjust VR402 (Height) so the vertical size is 180mm.

6. Horizontal Hold (H. Hold) adjustment

1) Turn the horizontal hold control (VR511) and find the position in the low oscillator frequency direction at which the screen begins to move (f_{LOW}) and the position in the high oscillator frequency direction at which the screen begins to move (f_{HIGH}).
2) Set the adjustment to the point physically halfway between the f_{LOW} and f_{HIGH} positions found in step 1.

7. Vertical Hold (V. Hold) adjustment

Turn the vertical hold control (VR401) in the direction of lower oscillation frequencies (clockwise) until the screen begins to roll. Then, turn the adjustment back counter-clockwise until the vertical synchronization takes hold (the position is about 45 degrees clockwise from center).

8. Sub Horizontal Phase Control (Sub H.P.C.) adjustment

Center the image in the middle of the screen with the sub H.P.C. control (VR502).

9. V. Center adjustment

Adjust VR403 (V. Center) to locate the character area at the CRT center.

10. CRT cutoff, Sub Bright, White balance adjustment

1) Input the window pattern of R.G.B.I. with the signal generator.
2) Set the Sub Bright VR (VR1301), low light VR (VR631, VR632, VR633) and Drive VR (VR621, VR623) to the mechanical center.
3) Turn the brightness control (VR501) to MIN.
4) Turn the screen control until it comes to the point where the back raster and flyback line disappear.
5) Connect a digital voltmeter provided with a high impedance probe, between the test point of the CRT G2 (TP65) and ground (TP66) and measure G2 voltage. Then, turn the screen VR to the extent of −10V, thereby reducing G2 voltage. After this, remove the probe.
6) Turn the brightness contorl (VR501) to MAX.
7) Turn the SUB-BRIGHT control (VR1301) to adjust the luminance to 100 cd/m^2 (nit).
8) Turn the R-Drive control (VR621) and B-Drive contorl (VR623) until the chrominance is X = 0.281 and Y = 0.311, respectively.
9) Turning the brightness control (VR501), set the luminance to 5 ~ 10cd/m^2 (nit).
10) Check the chrominance volue and if it comes out of the specified chrominance range, turn the low light control R-LOW, G-LOW and B-LOW until it comes within the specification.
11) Cause the brightness control to be varied from maximum value to the minimum value and confirm the luminance and the color tracking. If anything is found unusual, repeat the steps 6) to 10).
12) Lock the screen control with lacquer coating.

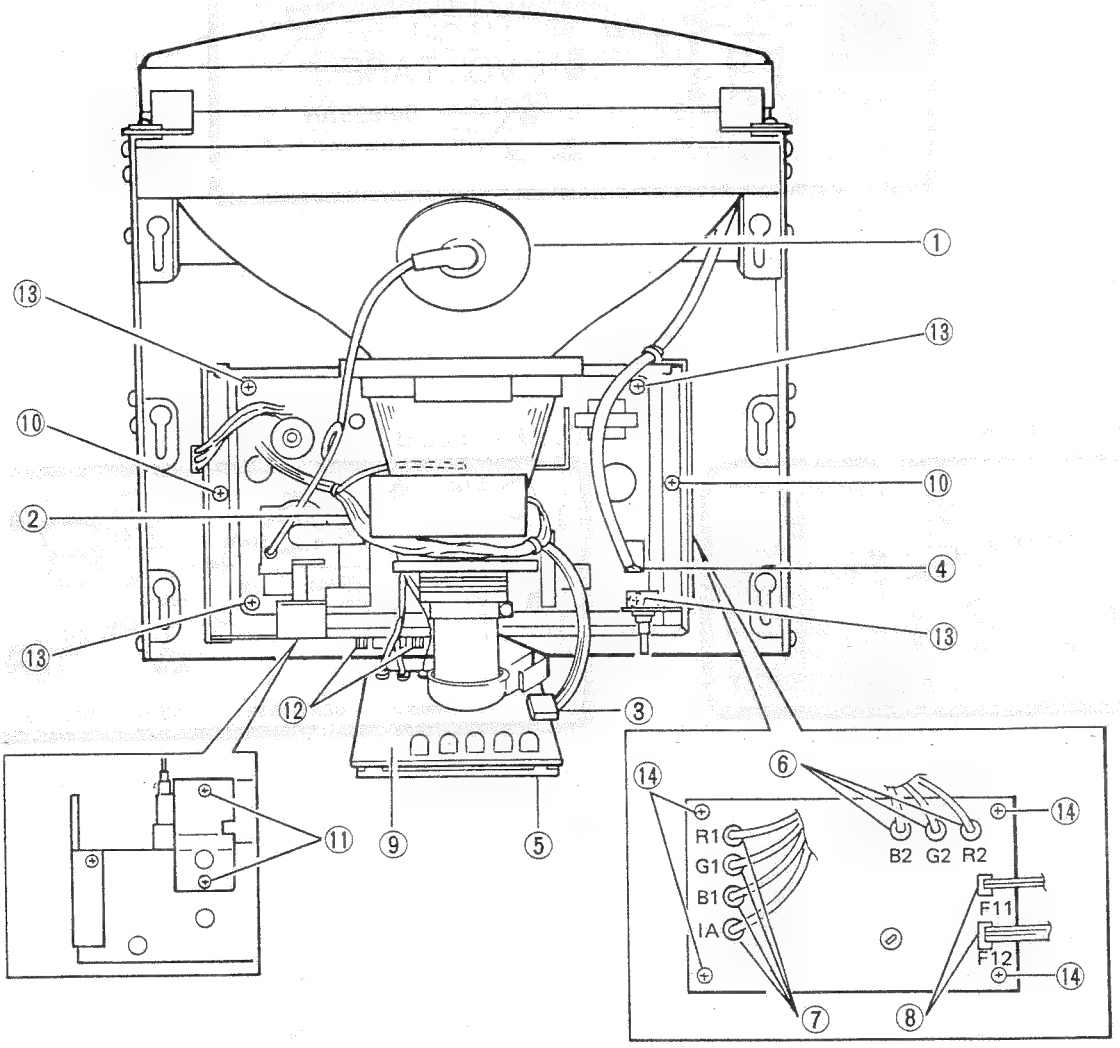
11. Focus adjustment

Turn the focus knob to make sure the focusing of the entire image is changed uniformly, and set the knob to a position where the focus balance of red, green, and blue colors is best.

DISASSEMBLY INSTRUCTIONS

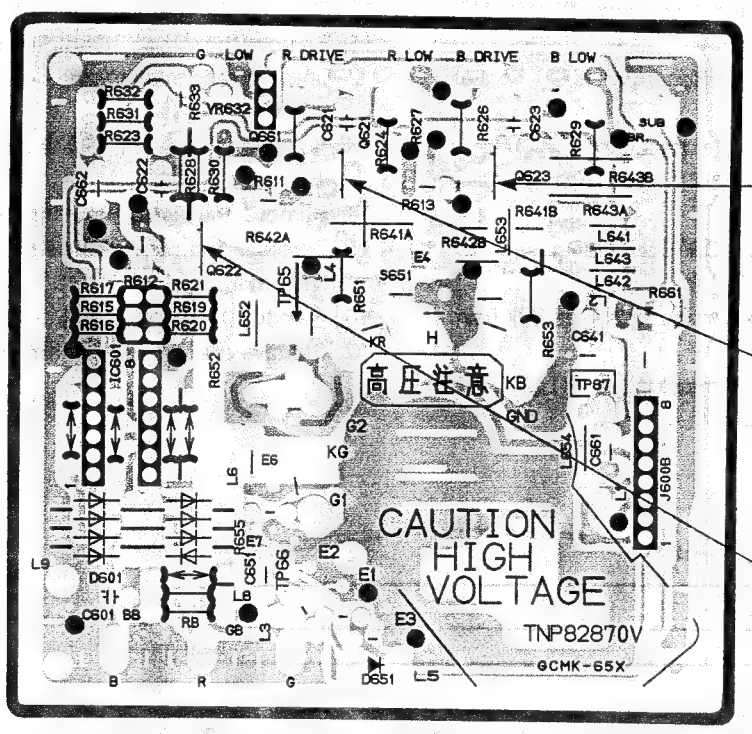
Chassis Block Removal (Main, CRT and Interface P.W.A.)

1. Remove the anode cap ① (Care must be taken as high voltage may be remaining.)
2. Desolder and remove the DY lead wires ② (V1, V2, H1, H2) from main P.W.A.
3. Remove the connector ③ from the CRT socket P.W.A.
4. Remove the connector for the degaussing coil ④
5. Desolder and remove the shield plate ⑤ from CRT socket P.W.A.
6. Desolder and remove the CRT grounding wire E1 from CRT socket P.W.A.
7. Remove the signal connector ⑥ (R2, G2, B2) from the Interface P.W.A.
8. Remove the signal input connector ⑦ (R1, G1, B1, IA) from Interface P.W.A.
9. Remove the connector ⑧ (F11, F12) from the Interface P.W.A.
10. Remove the CRT socket P.W.A. ⑨ from the CRT.
11. Remove the screws ⑩ holding the chassis.
12. Desolder and remove the transistor lead wires Q541 from main P.W.A.
13. Remove the screw ⑪ holding the FBT holding bracket.
14. Remove the signal input connector ⑫ (3mm nut).
15. Desolder and remove the signal input connector leads from main P.W.A.
16. Remove the screws ⑬ holding the main P.W.A.
17. Remove the screws ⑭ holding the Interface P.W.A.



CIRCUIT BOARD SOLDER VIEW

CRT P.C. Board

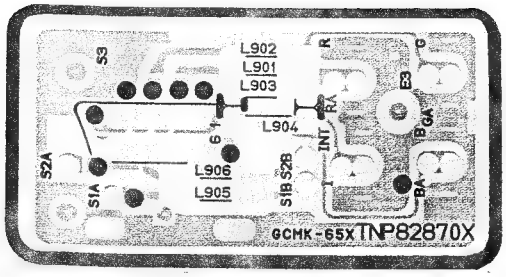


Q623 Video Out	
B	0.44V
C	93.6V
E	0.42V

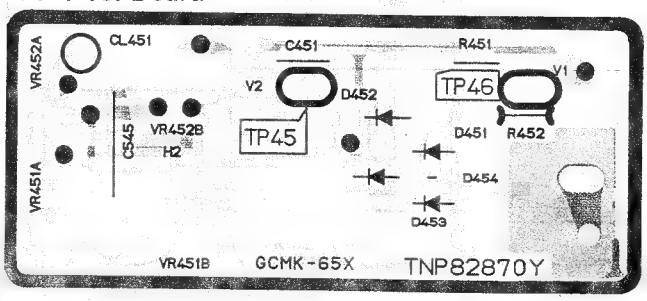
Q621 Video Out	
B	0.34V
C	93.6V
E	0.37V

Q622 Video Out	
B	0.42V
C	93.6V
E	0.44V

Signal P.C. Board



D.Y.P.C. Board



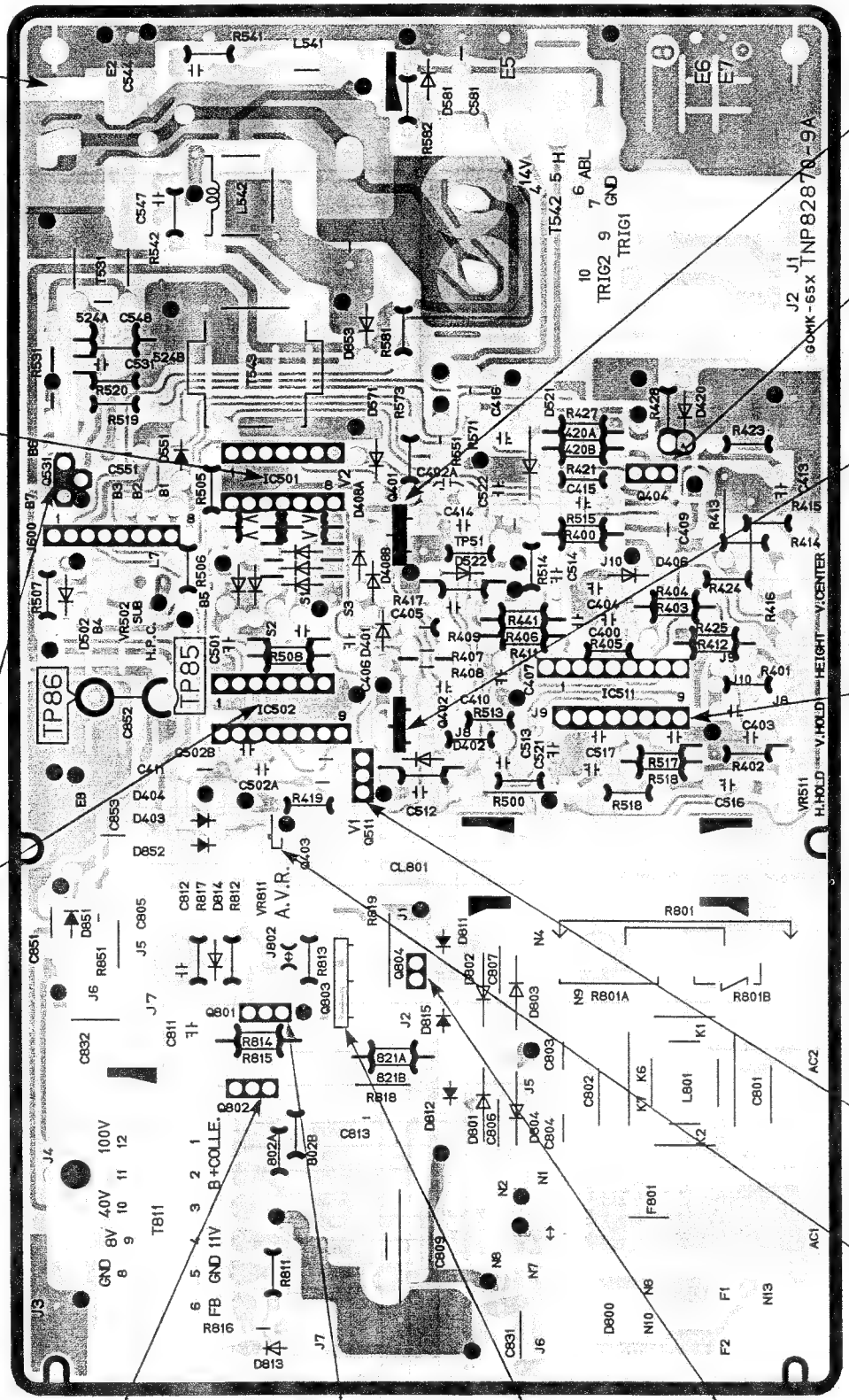
: Parts Side

: Solder Side

: Double Masking

• : Connect point of solder side and parts side

CIRCUIT BOARD-SOLDER VIEW



Q541 H. Out	
B	−0.12V
C	85V
E	0V

IC501 Polarity Switch	
1	5.3V
2	5.3V
3	0.12V
4	5.3V
5	0.38V
6	4.3V
7	0V
8	4.3V
9	0.37V
10	5.3V
11	0.15V
12	0V
13	87mV
14	5.3V

Q531 H. Drive	
B	0.37V
C	35.9V
E	0V

IC502 H. P.C.	
1	0V
2	3.8V
3	5.3V
4	1.17V
5	1.4V
6	3.9V
7	0.21V
8	0V
9	3.7V
10	5.3V
11	5.3V
12	2.8V
13	3.7V
14	1.6V
15	−0.68V
16	5.3V

Q401 V. Out	
B	0.6V
C	19.3V
E	0V

Q404 Side Pin	
B	3.1V
C	10.2V
E	2.5V

Q402 V. Out	
B	21.3V
C	38.1V
E	21.3V

IC511 V.H. Def.	
1	0.6V
2	4.2V
3	7.1V
4	4.1V
5	12.5V
6	4.4V
7	4.4V
8	1.3V
9	11.9V
10	15.3V
11	3.6V
12	6.8V
13	6.6V
14	12.6V
15	1.6V
16	0V
17	0.7V
18	0V

Q511 Phase Inverter	
B	0.53V
C	3.43V
E	0V

Q403 Pump Up	
B	38.1V
C	100V
E	38.8V

Q802 Pulse Control	
B	0.45V
C	0.01V
E	0V

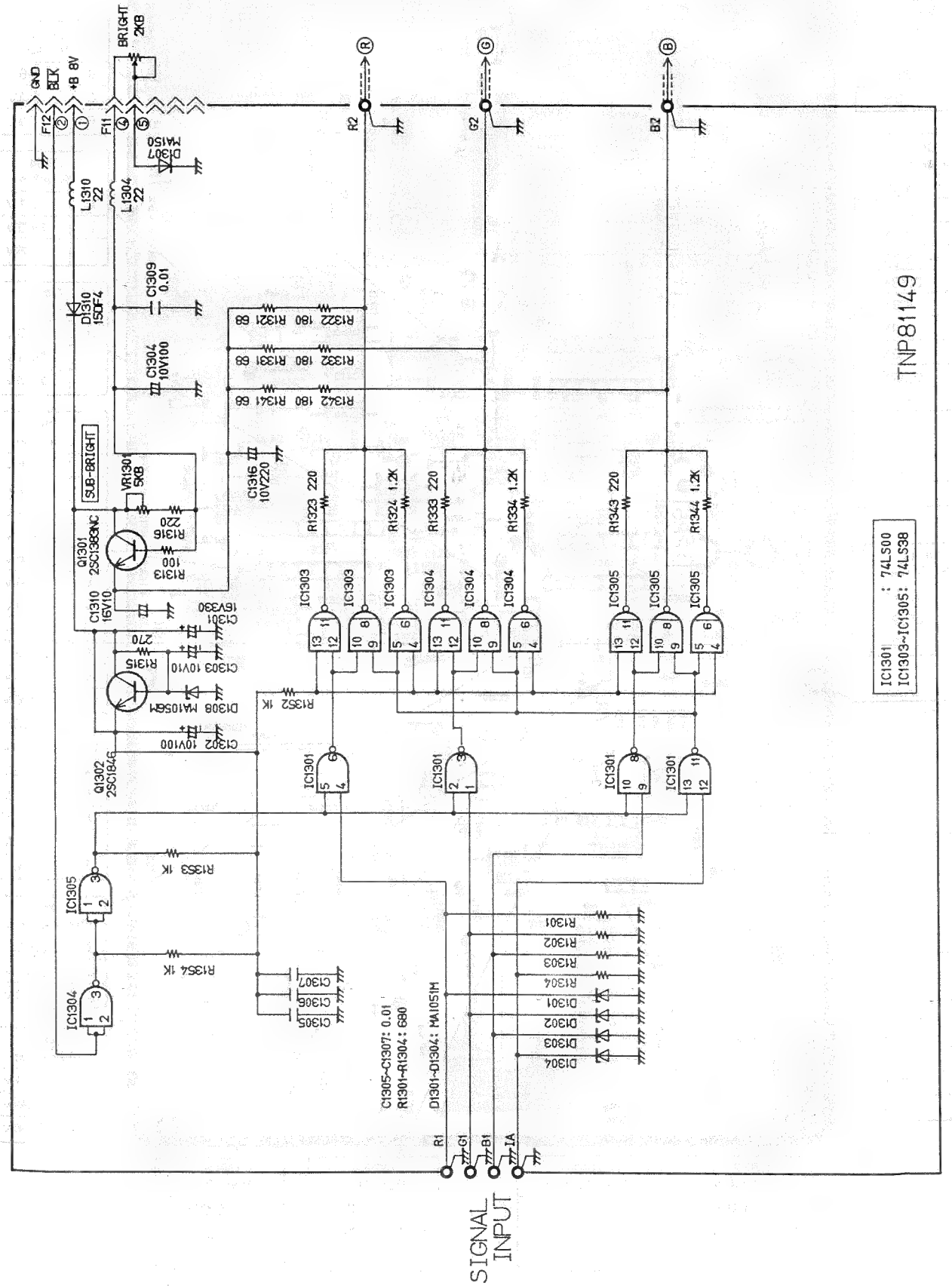
Q801 Reg. Control	
B	3.3V
C	0.7V
E	4.0V

Q803 Reg. Out	
B	0.01V
C	280V
E	0.06V

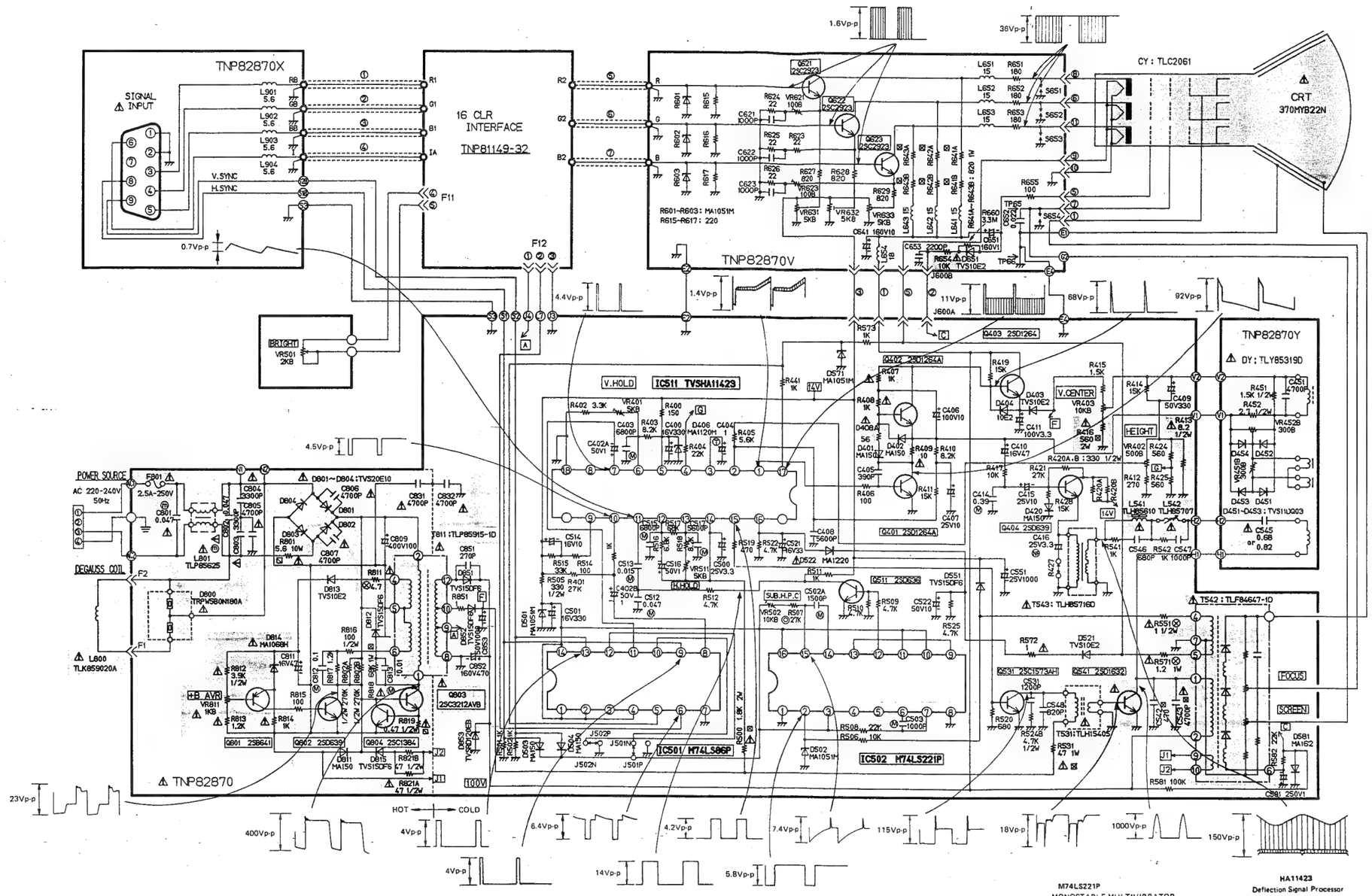
Q804 Reg. Out	
B	0.06V
C	0.01V
E	0V

: Parts Side : Solder Side : Double Masking • : Connect point of solder side and parts side

SCHEMATIC DIAGRAM FOR INTERFACE UNIT



SCHEMATIC DIAGRAM FOR MODEL TX-1413FHE



IMPORTANT SAFETY NOTICE

The components identified by shading or the international symbol ⚠ on this schematic diagram incorporate special features important for protection from X-Radiation, fire and electrical shock hazards. When servicing, it is essential that only manufacturer's specified parts be used for those critical components.

NOTE

1. **RESISTOR**
   All resistors are 1/4W resistor.
   Unit of resistance is OHM(Ω). (K=1,000, M=1,000,000)
2. **CAPACITOR**
   Unit of capacitance is μF unless otherwise noted.
3. **COIL**
   Unit of inductance is μH.
4. **VOLTAGE MEASUREMENT**
   a. Voltage is measured by a digital meter with DC 10MΩ OHM/V receiving normal signal.
   b. Use each measurement voltage for reference.

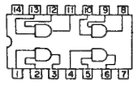
TRANSISTOR, DIODE & INTEGRATED CIRCUIT TERMINAL GUIDE	
	2SB641 2SD636 2SD639
	2SC1383 2SC1573AH
	2SD1264 2SD1264A
	2SC2923
	2SD1541 2SC3212A 2SD1632 2SC3210
	M74ALS08P M74LS86P
	M74LS221P
	HA11423
	silver .....20E10 purple 10E2
	15DF6
	white .....MA150 black MA162
	red-brown .....MA1120M red-red MA1220M
	brown-brown-green ..... MA1051M, RD120EB Gray-Gray-blue MA1068H
	LN217RP
	IIDQ03

SERVICE NOTE

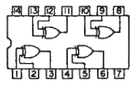
This model has a section that does not share a common ground with the power supply section. The different sections are referred to as the HOT section and the COLD section in the precautions below.

1. Do not touch the HOT section and the COLD section at the same time. You may receive an electric shock.
2. Do not short the HOT section to the COLD section. This could blow the fuse or even damage parts.
3. Never measure the HOT section and the COLD section at the same time when using tools such as oscilloscopes or multimeters.
4. Always unplug the unit before beginning any operation such as removing the chassis.

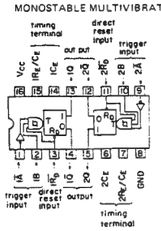
M74ALS08P
QUADRUPLE 2-INPUT POSITIVE AND GATE



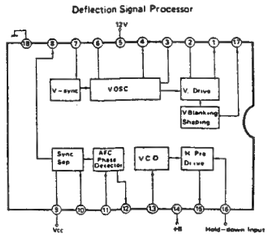
M74LS86P
QUADRUPLE 2-INPUT EXCLUSIVE OR GATE



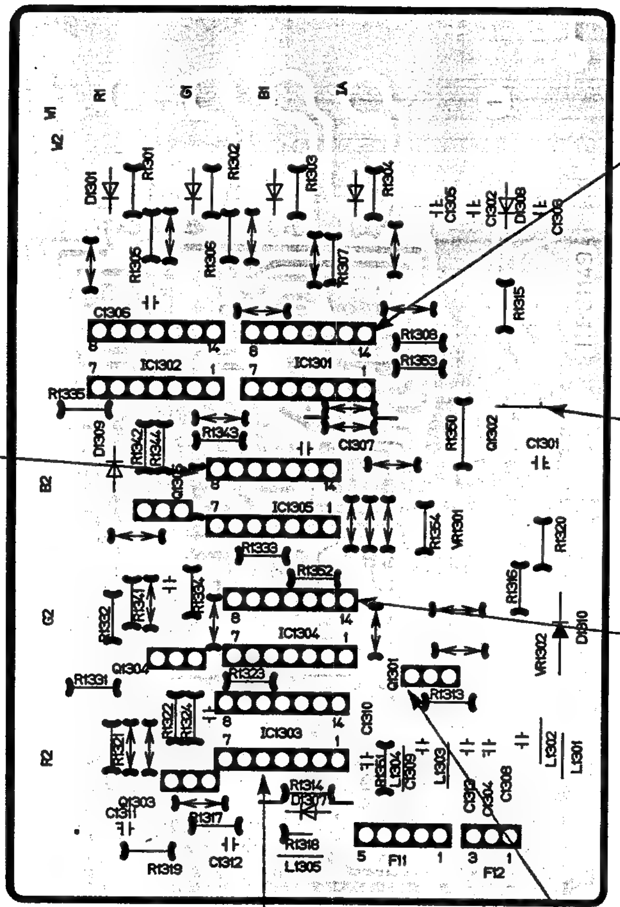
M74LS221P
MONOSTABLE MULTIVIBRATOR



HA11423
Deflection Signal Processor



INTERFACE CIRCUIT BOARD-SOLDER VIEW



IC1305 D/A Converter	
1	1.0V
2	1.0V
3	4.1V
4	5.0V
5	4.4V
6	0.1V
7	0V
8	0.3V
9	4.4V
10	4.4V
11	0.1V
12	4.4V
13	5.0V
14	5.0V

IC1301 D/A Converter	
1	0.7V
2	4.2V
3	3.5V
4	0.3V
5	4.2V
6	4.2V
7	0V
8	4.4V
9	0.3V
10	4.2V
11	4.4V
12	4.1V
13	0.3V
14	5.0V

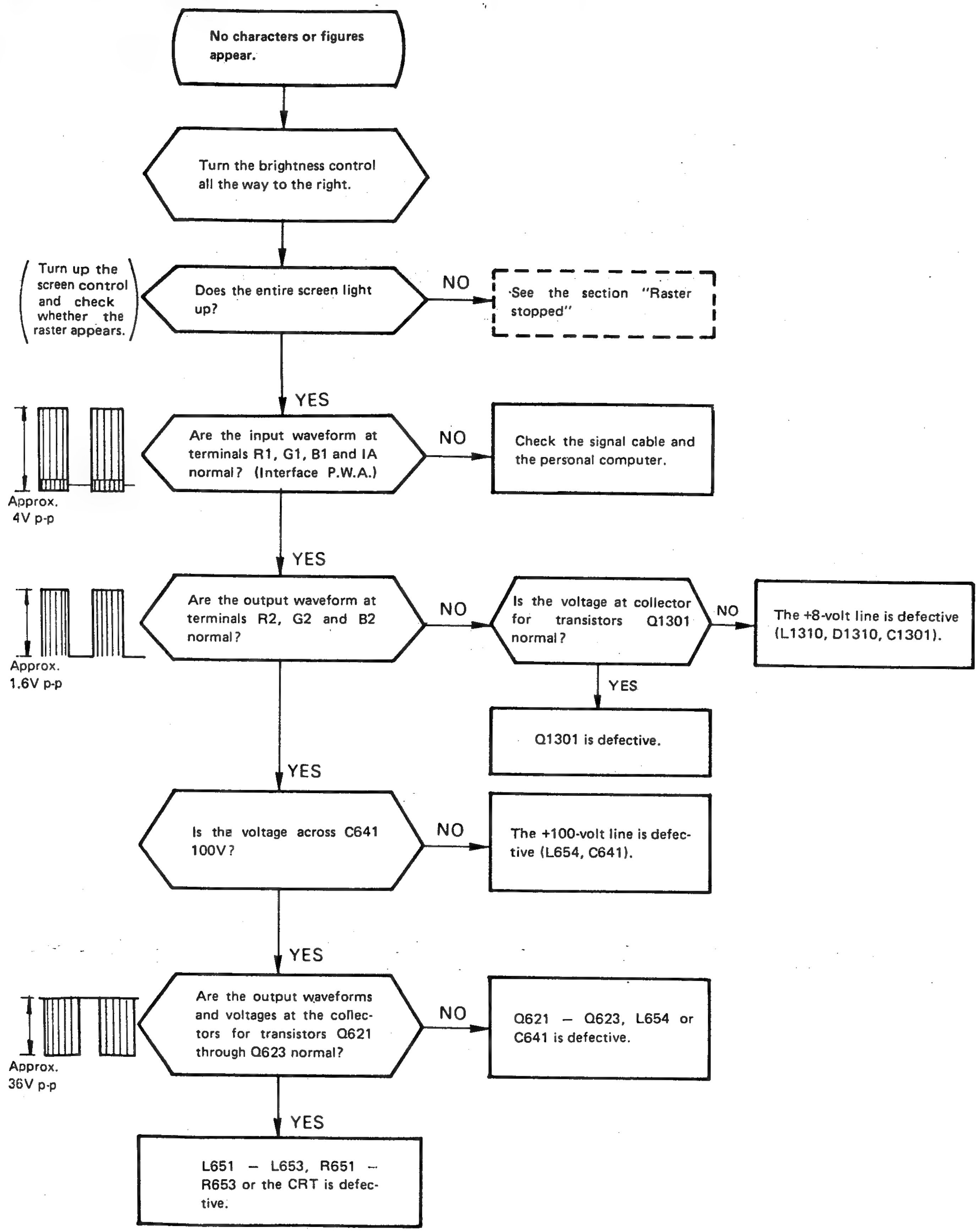
Q1302 +5V AVR	
B	5.7V
C	7.8V
E	5.0V

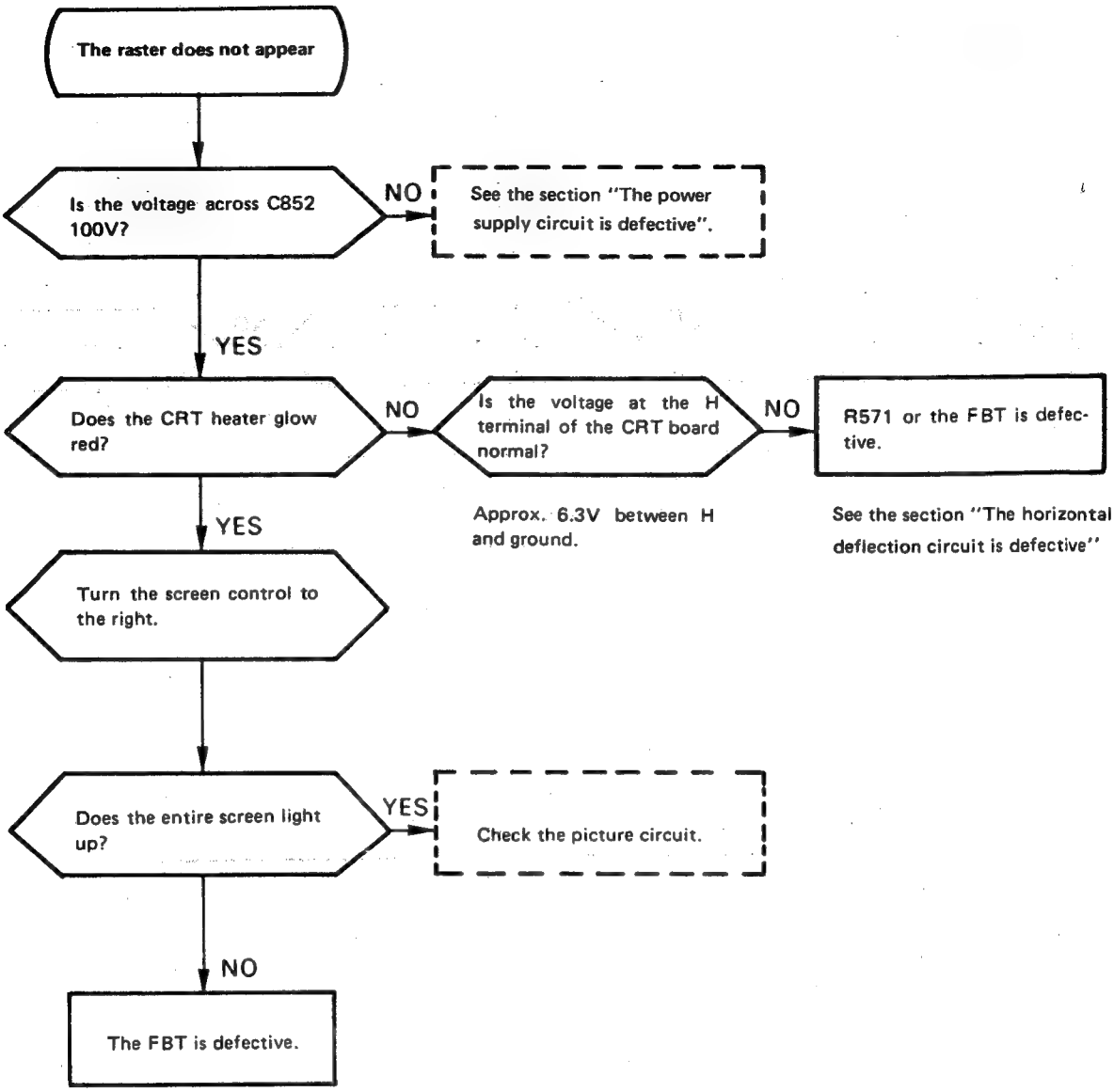
IC1304 D/A Converter	
1	4.2V
2	4.2V
3	1.0V
4	5.0V
5	4.4V
6	0.1V
7	0V
8	0.4V
9	4.4V
10	3.5V
11	0.2V
12	3.5V
13	5.0V
14	5.0V

IC1303 D/A Converter	
1	1.9V
2	1.9V
3	0.1V
4	5.0V
5	4.4V
6	0.1V
7	0V
8	0.3V
9	4.4V
10	4.2V
11	0.1V
12	4.2V
13	5.0V
14	5.0V

Q1301 Brightness Control	
B	4.4V ~ 0.7V
C	7.8V ~ 8.1V
E	3.8V ~ 0.14V

TROUBLE SHOOTING HINTS




The raster does not appear
Is the voltage across C852 100V?
NO
See the section "The power supply circuit is defective".
YES
Does the CRT heater glow red?
NO
Is the voltage at the H terminal of the CRT board normal?
NO
R571 or the FBT is defective.
Approx. 6.3V between H and ground.
See the section "The horizontal deflection circuit is defective"
YES
Turn the screen control to the right.
Does the entire screen light up?
YES
Check the picture circuit.
NO
The FBT is defective.

The horizontal deflection circuit is defective.

Is the voltage across C852 100V?

NO

Is the fuse normal? — NO → Replace the fuse. — NO → Is the fuse normal? — NO → The power supply circuit is defective or Q541 is shorted out.

YES

Is the power supply circuit normal? — NO → The power supply circuit is defective.

YES

Approx. 18V p-p

Is the waveform at the base of Q541 normal? — YES → The FBT is defective.

NO

Approx. 0.8V p-p

Is the waveform at the base of Q531 normal? — YES → Q531 or T531 is defective.

NO

Approx. 4.2V p-p

Is the waveform normal at pin 15 of IC511? — YES → R519 or R520 is defective.

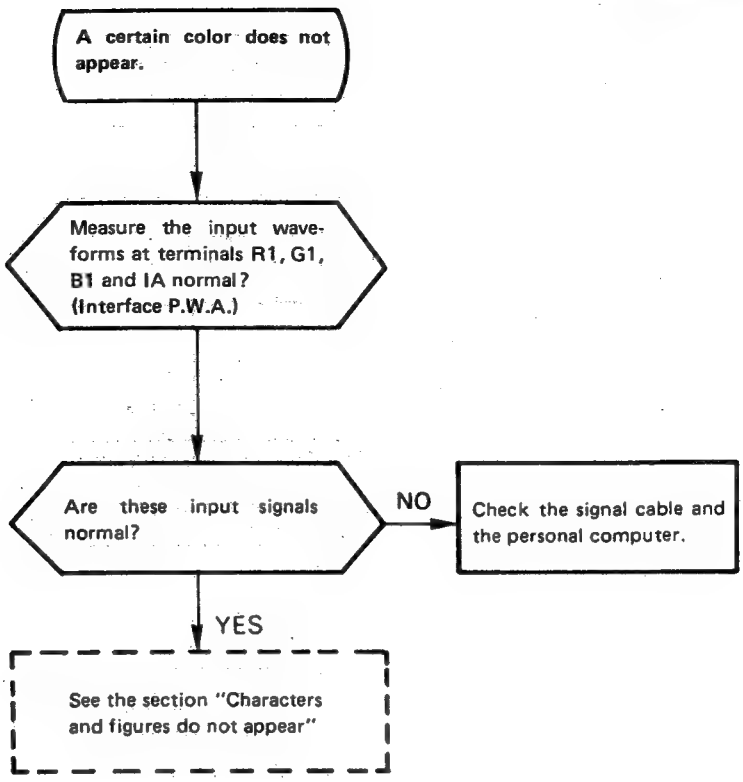
NO

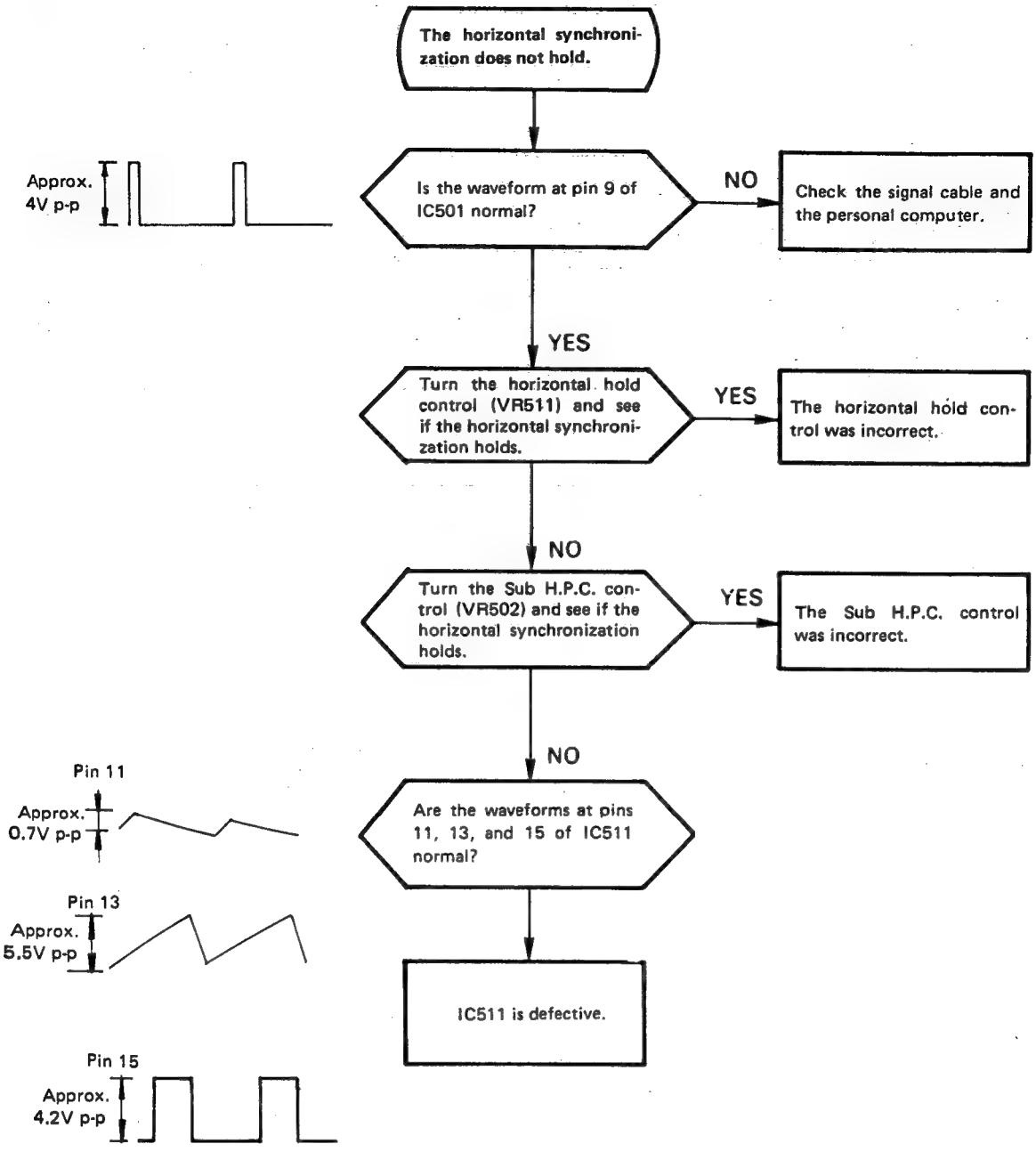
Is the voltage at pin 14 of IC511 about 12.6V? — NO → Check the +40V line. Check R500.

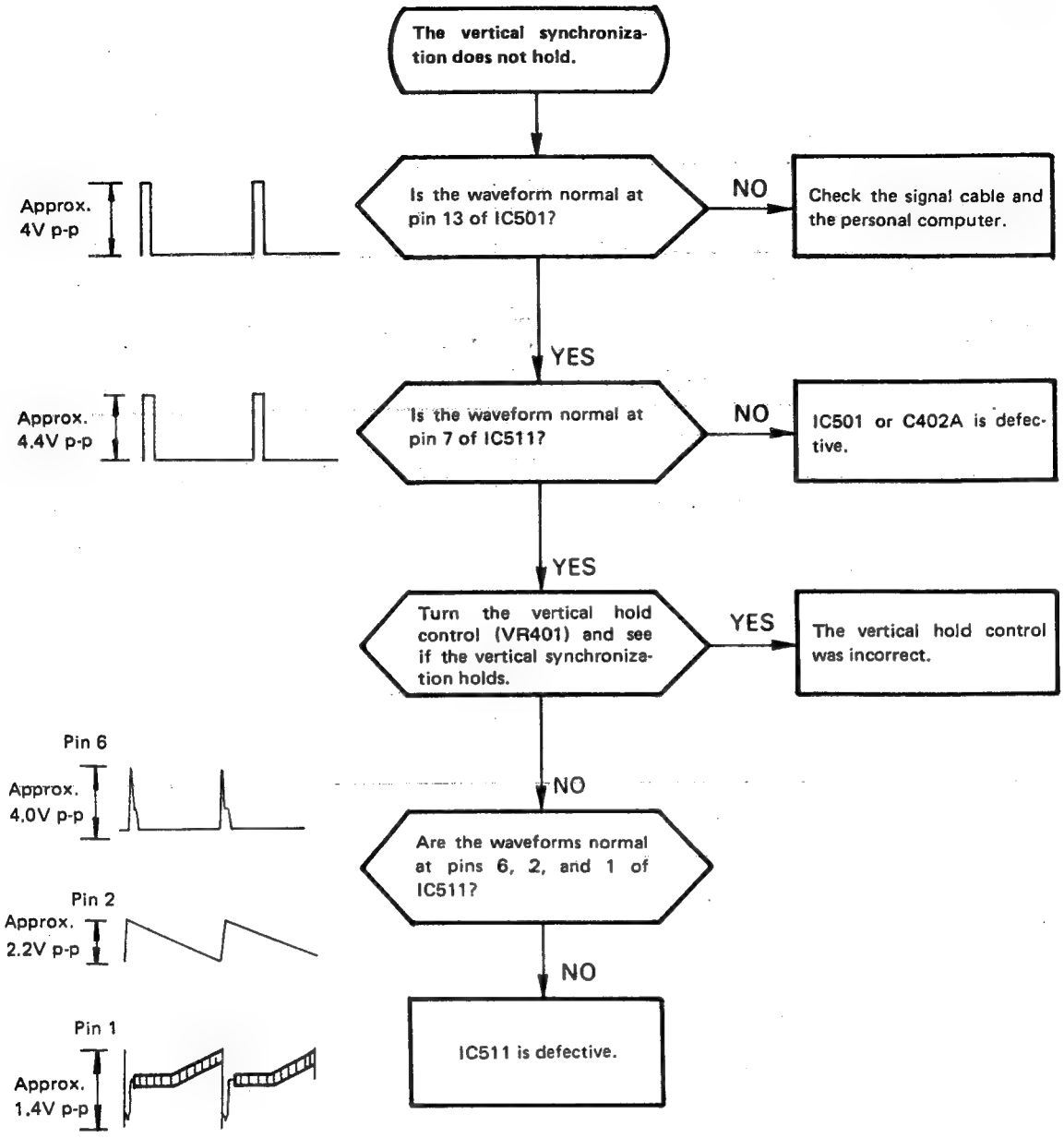
YES

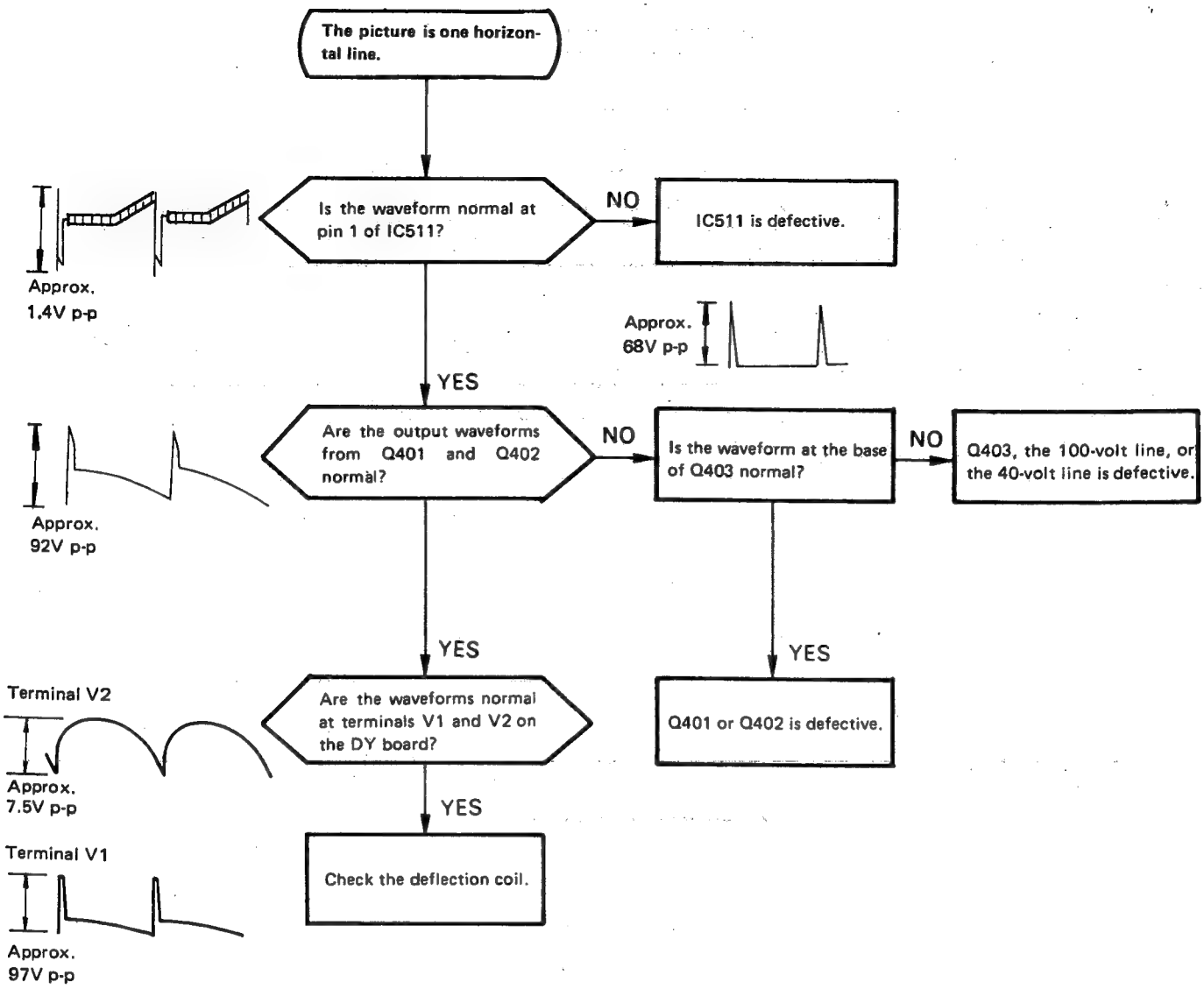
IC511 is defective.


Approx.
4V p-p


A certain color does not appear.
Measure the input waveforms at terminals R1, G1, B1 and IA normal? (Interface P.W.A.)
Are these input signals normal?
NO
Check the signal cable and the personal computer.
YES
See the section "Characters and figures do not appear"


The horizontal synchronization does not hold.
Is the waveform at pin 9 of IC501 normal?
NO
Check the signal cable and the personal computer.
Approx. 4V p-p
YES
Turn the horizontal hold control (VR511) and see if the horizontal synchronization holds.
YES
The horizontal hold control was incorrect.
NO
Turn the Sub H.P.C. control (VR502) and see if the horizontal synchronization holds.
YES
The Sub H.P.C. control was incorrect.
NO
Are the waveforms at pins 11, 13, and 15 of IC511 normal?
IC511 is defective.
Pin 11
Approx. 0.7V p-p
Pin 13
Approx. 5.5V p-p
Pin 15
Approx. 4.2V p-p


The vertical synchronization does not hold.
Is the waveform normal at pin 13 of IC501?
NO
Check the signal cable and the personal computer.
Approx. 4V p-p
YES
Is the waveform normal at pin 7 of IC511?
NO
IC501 or C402A is defective.
Approx. 4.4V p-p
YES
Turn the vertical hold control (VR401) and see if the vertical synchronization holds.
YES
The vertical hold control was incorrect.
NO
Are the waveforms normal at pins 6, 2, and 1 of IC511?
NO
IC511 is defective.
Pin 6
Approx. 4.0V p-p
Pin 2
Approx. 2.2V p-p
Pin 1
Approx. 1.4V p-p


The picture is one horizontal line.
Is the waveform normal at pin 1 of IC511?
NO
IC511 is defective.
Approx. 1.4V p-p
Approx. 68V p-p
YES
Are the output waveforms from Q401 and Q402 normal?
NO
Is the waveform at the base of Q403 normal?
NO
Q403, the 100-volt line, or the 40-volt line is defective.
Approx. 92V p-p
YES
YES
Are the waveforms normal at terminals V1 and V2 on the DY board?
Q401 or Q402 is defective.
Terminal V2
Approx. 7.5V p-p
YES
Terminal V1
Check the deflection coil.
Approx. 97V p-p

The much side pincushion distortion.

Is the waveform at the base of Q404 normal?

YES → Check C410, R417, C414, C415, R428, and D420.

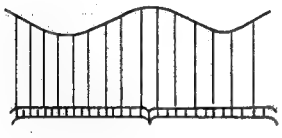
Approx. 7.2V p-p

NO

Is the output waveform from the secondary winding of transformer T543 normal?

YES → The horizontal deflection circuit is defective.

Approx. 150V p-p



NO

T543, C416, or Q404 is defective.

The power supply circuit is defective.

Is the voltage across C809 about 285V?

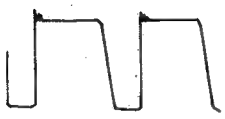
NO → The noise filter or the rectifier circuit is defective.

YES

Is the waveform at the collector of Q803 normal?

NO → Check Q803, R802A, R802B, R816, C812, and R817.

Approx. 400V p-p



YES

Check T811, C851, D851, C852, R851, D852, and C853.

REPLACEMENT PARTS LIST

Important Safety Notice

Components identified by the International symbol ⚠ have special characteristics important for safety. When replacing any of these components use only manufacture's specified parts.

RESISTOR

PART NAME & DESCRIPTION			
TYPE		ALLOWANCE	
C	Carbon	F	± 1%
F	Fuse	J	± 5%
M	Metal Oxide	K	± 10%
S	Solid	M	± 20%
W	Wire Wound	G	± 2%

Example: Part No. ERD25TJ104 Ⓒ Description 100K Ⓙ 1/4W

CAPACITOR

PART NAME & DESCRIPTION			
TYPE		ALLOWANCE	
C	Ceramic	C	± 0.25pF
E	Electrolytic	D	± 0.5pF
P	Polyester	F	± 1pF
S	Styrol	J	± 5%
T	Tantalum	K	± 10%
PP	Polypropylene	L	± 15%
		M	± 20%
		P	+100% −0%
		Z	+80% −20%

Example: Part No. ECKF1H103ZF Ⓒ Description 0.01μF Ⓩ 50V

	Ref.No.	Part No.	Description
		CABINET & MAIN PARTS	
⚠		TKX822001	PC BOARD HOLDER(BIG)
		TUW85903	SIDE PLATE(R)
		TUW85904	SIDE PLATE(L)
		TUX80701-2	CORD BRACKET (BIG)
		TUX80971	CORD BRACKET
		TUX85106	UPPER PLATE
		TUX85121	BRACKET (CRT)
		TUX85122	PCB BRACKET
		TUX85427-3	CHASSIS BRACKET(A)
		TUX85428	CHASSIS BRACKET(C)
		TUX85452	IF BRACKET
		TUX85819-3	SIDE BRACKET(R)
		TUX85820-3	SIDE BRACKET(L)
		TUX85884-1	BOTTOM PLATE
		TUC85210-1	SHIELD PLATE
⚠		TBM85260	MODEL PLATE
		TES201	SPRING(COIL)
		TMM1455	BEADS BAND
		TMM81416	CORD BAND (SMALL)
		TMM81417	CORD BAND (BIG)
⚠		TMM81454	CORD BAND
		TMM85210	CRT SOCKET COVER
⚠		TMM85411	BARRIER (EDGE)
		TMM85511	RUBBER (WEDGE)
		TMK84549	PARMALLOY (BIG)
		TMK84557	PARMALLOY (SMALL)
		XNS8	NUT
		XTB4+12A	SCREW
		XTB4+16F	SCREW
		XTB4+35B	SCREW
		XTV3+10A	SCREW
		XTV3+12C	SCREW
		XTV3+8F	SCREW
		XTW3+6L	SCREW
		XWA4B	WASHER
		XWA5B	WASHER
		XWC3BFN	WASHER
		XWG3F10	WASHER
		XWG5H17	WASHER
		XWS8A	WASHER
		XYA4+EF8	SCREW
		370MYB22NS	PICTURE TUBE
		TNP81149-32	PC BOARD W/COMPONENT(IF)
⚠		TNP82870-35	PC BOARD W/COMPONENT(M)
⚠		TLY85319D	DEFLECTION YOKE
		TLC2061	CONVERGENCE COIL
⚠		TLK859020A	DEGAUSS COIL
		TJS828790	9P SOCKET
		TJT8907B	SOCKET
		TXAJTA4P424	4P CONNECTOR ASSY
		TXAJTC8P027	8P CONNECTOR ASSY
		TXAJTE2P163	2P CONNECTOR ASSY
⚠		2SD1632RL	TRANSISTOR
	VR501	EVH5WAF25B23	CONTROL B 2K OHM
		T4F72425Q	COTTON TAPE 55M
		T4F80918-1	TAPE
		T4F90219-1	MAIRA TAPE 20M
		TPC852841	OUTER CARTON
		TPD359005	FILLER(PAD)
		TXAPD21404XE	FILLER
		TPE814055	SET COVER
		TQF14875	HIGH VOLTAGE LABEL
		TQF80759	WARNING LABEL
		TQF81259	SERIAL NO LABEL
		TQF83647	FUSE LABEL
		I.C	
	IC501	M74LS86P	INTEGRATED CIRCUIT
	IC502	M74LS221P	INTEGRATED CIRCUIT
	IC511	TVSHA11423	INTEGRATED CIRCUIT
	IC1301	M74LS00P	INTEGRATED CIRCUIT

	Ref.No.	Part No.	Description
	IC1303	M74LS38P	INTEGRATED CIRCUIT
	IC1304	M74LS38P	INTEGRATED CIRCUIT
	IC1305	M74LS38P	INTEGRATED CIRCUIT
			TRANSISTORS
	Q401	2SD1264AQLB	TRANSISTOR
	Q402	2SD1264AQLB	TRANSISTOR
	Q403	2SD1264PLB	TRANSISTOR
	Q404	2SD639R	TRANSISTOR
	Q511	2SD636R	TRANSISTOR
	Q531	2SC1573AH	TRANSISTOR
	Q621	2SC2923	TRANSISTOR
	Q622	2SC2923	TRANSISTOR
	Q623	2SC2923	TRANSISTOR
	Q801	2SB641R	TRANSISTOR
	Q802	2SD639R	TRANSISTOR
⚠	Q803	2SC3212A	TRANSISTOR
	Q804	2SC1384Q	TRANSISTOR
	Q1301	2SC1383QNC	TRANSISTOR
	Q1302	2SC1846Q	TRANSISTOR
			DIODES
	D401	MA150	DIODE
	D402	MA150	DIODE
	D403	TVS10E2	DIODE
	D404	TVS10E2	DIODE
	D406	MA1120M	DIODE
⚠	D408A	ERD25FJ560K	C 56 OHM J 1/4W
	D420	MA150	DIODE
	D451	TVS11DQ03C	DIODE
	D452	TVS11DQ03C	DIODE
	D453	TVS11DQ03C	DIODE
	D454	TVS11DQ03C	DIODE
	D501	MA1051M	DIODE
	D502	MA1051M	DIODE
	D503	MA150	DIODE
	D504	MA150	DIODE
	D521	TVS10E2	DIODE
⚠	D522	MA1220M	DIODE
	D551	TVS15DF6	DIODE
	D571	MA1051M	DIODE
	D581	MA162	DIODE
	D651	TVS10E2	DIODE
⚠	D800	TRPW5B0N180A	THERMISTOR
⚠	D801	TVS20E10	DIODE
⚠	D802	TVS20E10	DIODE
⚠	D803	TVS20E10	DIODE
⚠	D804	TVS20E10	DIODE
	D811	MA150	DIODE
	D812	TVS15DF6	DIODE
	D813	TVS10E2	DIODE
⚠	D814	MA1068H	DIODE
	D815	TVS15DF6	DIODE
	D851	TVS15DF6	DIODE
	D852	TVS15DF6	DIODE
	D853	TVSRD120EB	DIODE
	D1301	MA1051M	DIODE
	D1302	MA1051M	DIODE
	D1303	MA1051M	DIODE
	D1304	MA1051M	DIODE
	D1307	MA150	DIODE
	D1308	MA1056M	DIODE

	Ref.No.	Part No.	Description
	D1310	TVS15DF4	DIODE
			COIL & TRANSFORMERS
⚠	L541	TLH85610	COIL
⚠	L542	TLH85707	COIL
	L641	TLU220J186	PEAKING COIL
	L642	TLU220J186	PEAKING COIL
	L643	TLU220J186	PEAKING COIL
	L651	TLU150K186	PEAKING COIL
	L652	TLU150K186	PEAKING COIL
	L653	TLU150K186	PEAKING COIL
	L654	TLU180J186	PEAKING COIL
⚠	L801	TLP85625	TRANS
	L1301	TLU220J186	PEAKING COIL
	L1304	TLU220J186	PEAKING COIL
⚠	T531	TLH15405	COIL
⚠	T542	TLF84647-1D	FLYBACK TRANS
⚠	T543	TLH85716D	COIL
⚠	T811	TLP85915-1D	TRANS
			CONTROL
	VR401	EVZX2H3B53	CONTROL B 5K OHM
	VR402	EVZX2H3B52	CONTROL B 500 OHM
	VR403	EVTK0CA00B14	CONTROL B 10K OHM
	VR451B	EVNK4BA00B32	CONTROL B 300 OHM
	VR452B	EVNK4BA00B32	CONTROL B 300 OHM
	VR502	EVMK4GA00B24	CONTROL B 20K OHM
	VR511	EVZX2H3B53	CONTROL B 5K OHM
	VR621	EVNK0BA00B12	CONTROL B 100 OHM
	VR623	EVNK0BA00B12	CONTROL B 100 OHM
	VR631	EVNK0BA00B53	CONTROL B 5K OHM
	VR632	EVNK0BA00B53	CONTROL B 5K OHM
	VR633	EVNK0BA00B53	CONTROL B 5K OHM
⚠	VR811	EVNK4BA00B13	CONTROL B 1K OHM
	VR1301	EVN4HCA00B53	CONTROL B 5K OHM
			CAPACITORS
	C400	ECEA1CU331	E 330UF 16V
	C402A	ECEA1HG010S	E 1UF 50V
	C402B	ECEA1HU010	E 1UF 50V
	C403	ECQB1H682JZ	P 6800PF J 50V
	C404	ECSF1VE105JN	T 1.0UF 35V
	C405	ECCF1H391J	C 390PF J 50V
	C406	ECEA1HG100	E 10UF 50V
	C407	ECEA1EU100	E 10UF 25V
	C408	ECKF1H562KB	C 5600PF K 50V
	C409	ECEA1HU331	E 330UF 50V
	C410	ECEA1CU470	E 47UF 16V
	C411	ECEA2AU010	E 1UF 100V
	C414	ECQV1H394JZ	P 0.39UF J 50V
	C415	ECEA1EU100	E 10UF 25V
	C416	ECEA1EN3R3S	E 3.3UF 25V
	C451	ECKD2H472KB2	C 4700PF K 500V
	C500	ECEA25Z3R3	E 3.3UF 25V
	C501	ECEA1CU331	E 330UF 16V
	C502A	ECQK1152JZ	P 1500PF J 100V
	C503	ECQK1102JZ	P 1000PF J 100V
	C512	ECQM1H473JZ	P 0.047UF J 50V
	C513	ECQM1H153JZ	P 0.015UF J 50V
	C514	ECEA1CU100	E 10UF 16V
	C515	ECQK1682JZ	P 6800PF J 100V

	Ref.No.	Part No.	Description			
	C516	ECEA1HU010	E	1UF		50V
	C517	ECQK1562JZ	P	5600PF	J	100V
	C521	ECEA1CU330	E	33UF		16V
	C522	ECEA1HU100	E	10UF		50V
	C531	ECKD2H122KB2	C	1200PF	K	500V
	C542	ECKC3D471KBN	C	470PF	K	2KV
⚠	C543	ECWH12H472JS	PP	4700PF	J	1.2KV
⚠	C545	ECWF2H824JZ	PP	0.82UF	J	500V
	C546	ECKD2H681KB2	C	680PF	K	500V
	C547	ECKD2H102KB2	C	1000PF	K	500V
	C548	ECKD2H471KB2	C	470PF	K	500V
	C551	ECEA1EFE102	E	1000UF		25V
	C581	ECEA2ES010	E	1UF		250V
	C621	ECKF1H102KB	C	1000PF	K	50V
	C622	ECKF1H102KB	C	1000PF	K	50V
	C623	ECKF1H102KB	C	1000PF	K	50V
	C641	ECEA2CG100S	E	10UF		160V
	C651	ECEA2CS010	E	1UF		160V
	C652	ECKC3D472KBN	C	4700PF	K	2KV
	C653	ECKD2H222KB2	C	2200PF	K	500V
⚠	C801	ECQE2A104MW	P	0.1UF	M	250V
⚠	C802	ECQE2A104MW	P	0.1UF	M	250V
⚠	C803	ECKCNS472MFJ	C	4700PF	M	
⚠	C804	ECKCNS472MFJ	C	4700PF	M	
⚠	C805	ECKCNS472MFJ	C	4700PF	M	
⚠	C806	ECKCNS472MFJ	C	4700PF	M	
⚠	C807	ECKCNS472MFJ	C	4700PF	M	
	C809	ECES2GV101	E	100UF		400V
	C811	ECEA16Z47	E	47UF		16V
	C812	ECQV1H104JZ	P	0.1UF	J	50V
	C813	ECQM4103KZ	P	0.01UF	K	400V
⚠	C831	ECKCNS472MFJ	C	4700PF	M	
⚠	C832	ECKCNS472MFJ	C	4700PF	M	
	C851	ECKC3D271JBN	C	270PF	J	2KV
	C852	ECES2CH471	E	470UF		160V
	C853	ECEA1HU102	E	1000UF		50V
	C1301	ECEA1CU331	E	330UF		16V
	C1302	ECEA1AU101	E	100UF		10V
	C1303	ECEA1CU100	E	10UF		16V
	C1304	ECEA1CU101	E	100UF		16V
	C1305	ECKF1H103ZF	C	0.01UF	Z	50V
	C1306	ECKF1H103ZF	C	0.01UF	Z	50V
	C1307	ECKF1H103ZF	C	0.01UF	Z	50V
	C1309	ECKF1H103ZF	C	0.01UF	Z	50V
	C1310	ECEA1CU100	E	10UF		16V
	C1316	ECEA1AU221	E	220UF		10V
		RESISTORS				
	R400	ERDS1FJ151	C	150 OHM	J	1/2W
	R401	ERD25FJ273K	C	27K OHM	J	1/4W
	R402	ERD25FJ332K	C	3.3K OHM	J	1/4W
	R403	ERD25FJ822K	C	8.2K OHM	J	1/4W
	R404	ERD25FJ223K	C	22K OHM	J	1/4W
	R405	ERD25FJ562K	C	5.6K OHM	J	1/4W
	R406	ERD25FJ101K	C	100 OHM	J	1/4W
⚠	R407	ERD25FJ102K	C	1K OHM	J	1/4W
⚠	R408	ERD25FJ102K	C	1K OHM	J	1/4W
⚠	R409	ERD25FJ100K	C	10 OHM	J	1/4W
	R410	ERD25FJ822K	C	8.2K OHM	J	1/4W
	R411	ERD25FJ153K	C	15K OHM	J	1/4W
	R412	ERD25FJ271K	C	270 OHM	J	1/4W
⚠	R413	ERD50FJ8R2	C	8.2 OHM	J	1/2W

	Ref.No.	Part No.	Description			
	R414	ERD25FJ153K	C	15K OHM	J	1/4W
	R415	ERD25FJ152K	C	1.5K OHM	J	1/4W
⚠	R416	ERG2SJ561	M	560 OHM	J	2W
	R417	ERD25FJ103K	C	10K OHM	J	1/4W
	R419	ERD25FJ153K	C	15K OHM	J	1/4W
	R420A	ERDS1FJ331	C	330 OHM	J	1/2W
	R420B	ERDS1FJ331	C	330 OHM	J	1/2W
	R421	ERD25FJ273K	C	27K OHM	J	1/4W
	R424	ERD25FJ561K	C	560 OHM	J	1/4W
	R425	ERD25FJ471K	C	470 OHM	J	1/4W
	R427	ERD25TC0	C	0 OHM		1/4W
	R428	ERD25FJ153K	C	15K OHM	J	1/4W
	R441	ERD25FJ102K	C	1K OHM	J	1/4W
	R451	ERDS1FJ152	C	1.5K OHM	J	1/2W
	R452	ERDS1FJ2R7	C	2.7 OHM	J	1/2W
⚠	R500	ERG2SJ182	M	1.8K OHM	J	2W
	R501	ERD25FJ102K	C	1K OHM	J	1/4W
	R502	ERD25FJ102K	C	1K OHM	J	1/4W
	R505	ERDS1FJ331	C	330 OHM	J	1/2W
	R506	ERDS1FJ103	C	10K OHM	J	1/2W
	R507	ER025CKF3302	M	33K OHM	F	1/4W
	R508	ERD25FJ223K	C	22K OHM	J	1/4W
	R509	ERD25FJ472K	C	4.7K OHM	J	1/4W
	R510	ERD25FJ472K	C	4.7K OHM	J	1/4W
	R511	ERD25FJ102K	C	1K OHM	J	1/4W
	R512	ERD25FJ472K	C	4.7K OHM	J	1/4W
	R514	ERD25FJ101K	C	100 OHM	J	1/4W
	R515	ERD25FJ333K	C	33K OHM	J	1/4W
	R516	ERD25FJ682K	C	6.8K OHM	J	1/4W
	R517	ERD25FJ683K	C	68K OHM	J	1/4W
	R518	ERD25FJ822K	C	8.2K OHM	J	1/4W
	R519	ERD25FJ471K	C	470 OHM	J	1/4W
	R520	ERD25FJ681K	C	680 OHM	J	1/4W
	R522	ERD25FJ472K	C	4.7K OHM	J	1/4W
	R524B	ERDS1FJ472	C	4.7K OHM	J	1/2W
	R525	ERD25FJ472K	C	4.7K OHM	J	1/4W
⚠	R531	ERG1SJ470	M	47 OHM	J	1W
	R541	ERD25FJ102K	C	1K OHM	J	1/4W
	R542	ERD25FJ102K	C	1K OHM	J	1/4W
⚠	R551	ERQ12HJ1R0	F	1 OHM	J	1/2W
⚠	R571	ERQ1CJ1R2	F	1.2 OHM	J	1W
⚠	R572	ERD25FJ1R0K	C	1 OHM	J	1/4W
	R573	ERD25FJ102K	C	1K OHM	J	1/4W
	R581	ERD25FJ334K	C	330K OHM	J	1/4W
	R582	ERD25FJ223K	C	22K OHM	J	1/4W
	R601	MA1051M	DIODE			
	R602	MA1051M	DIODE			
	R603	MA1051M	DIODE			
	R615	ERD25FJ221K	C	220 OHM	J	1/4W
	R616	ERD25FJ221K	C	220 OHM	J	1/4W
	R617	ERD25FJ221K	C	220 OHM	J	1/4W
	R623	ERD25FJ220K	C	22 OHM	J	1/4W
	R624	ERD25FJ220K	C	22 OHM	J	1/4W
	R625	ERD25FJ220K	C	22 OHM	J	1/4W
	R626	ERD25FJ220K	C	22 OHM	J	1/4W
	R627	ERD25FJ821K	C	820 OHM	J	1/4W
	R628	ERD25FJ821K	C	820 OHM	J	1/4W
	R629	ERD25FJ821K	C	820 OHM	J	1/4W
	R641A	ERG1ANJ821	M	820 OHM	J	1W
	R641B	ERG1ANJ821	M	820 OHM	J	1W
	R642A	ERG1ANJ821	M	820 OHM	J	1W
	R642B	ERG1ANJ821	M	820 OHM	J	1W

	Ref.No.	Part No.	Description			
	R643A	ERG1ANJ821	M	820 OHM	J	1W
	R643B	ERG1ANJ821	M	820 OHM	J	1W
	R651	ERD25FJ181K	C	180 OHM	J	1/4W
	R652	ERD25FJ181K	C	180 OHM	J	1/4W
	R653	ERD25FJ181K	C	180 OHM	J	1/4W
⚠	R654	ERD25FJ103K	C	10K OHM	J	1/4W
	R655	ERD25FJ101K	C	100 OHM	J	1/4W
	R660	ERDS1FJ335	C	3.3M OHM	J	1/2W
⚠	R801	ERF10ZYK5R6	W	5.6 OHM	K	10W
	R802A	ERDS1FJ274	C	270K OHM	J	1/2W
	R802B	ERDS1FJ274	C	270K OHM	J	1/2W
⚠	R811	ERQ14AJ4R7	F	4.7 OHM	J	1/4W
⚠	R812	ERDS1FJ392	C	3.9K OHM	J	1/2W
⚠	R813	ERD25FJ122K	C	1.2K OHM	J	1/4W
⚠	R814	ERD25FJ102K	C	1K OHM	J	1/4W
	R815	ERD25FJ101K	C	100 OHM	J	1/4W
	R816	ERD50FJ101	C	100 OHM	J	1/2W
	R817	ERD25FJ122K	C	1.2K OHM	J	1/4W
⚠	R818	ERG1ANJ683	M	68K OHM	J	1W
⚠	R819	ERW12PKR47	W	0.47 OHM	K	1/2W
⚠	R821A	ERDS1FJ470	C	47 OHM	J	1/2W
	R821B	ERDS1FJ470	C	47 OHM	J	1/2W
	R851	ERD25FJ1R0K	C	1 OHM	J	1/4W
	R1301	ERD25FJ681K	C	680 OHM	J	1/4W
	R1302	ERD25FJ681K	C	680 OHM	J	1/4W
	R1303	ERD25FJ681K	C	680 OHM	J	1/4W
	R1304	ERD25FJ681K	C	680 OHM	J	1/4W
	R1313	ERD25FJ101K	C	100 OHM	J	1/4W
	R1315	ERD25FJ271K	C	270 OHM	J	1/4W
	R1316	ERD25FJ221K	C	220 OHM	J	1/4W
	R1321	ERD25FJ680K	C	68 OHM	J	1/4W
	R1322	ERD25FJ181K	C	180 OHM	J	1/4W
	R1323	ERD25FJ221K	C	220 OHM	J	1/4W
	R1324	ERD25FJ122K	C	1.2K OHM	J	1/4W
	R1331	ERD25FJ680K	C	68 OHM	J	1/4W
	R1332	ERD25FJ181K	C	180 OHM	J	1/4W
	R1333	ERD25FJ221K	C	220 OHM	J	1/4W
	R1334	ERD25FJ122K	C	1.2K OHM	J	1/4W
	R1341	ERD25FJ680K	C	68 OHM	J	1/4W
	R1342	ERD25FJ181K	C	180 OHM	J	1/4W
	R1343	ERD25FJ221K	C	220 OHM	J	1/4W
	R1344	ERD25FJ122K	C	1.2K OHM	J	1/4W
	R1352	ERD25FJ102K	C	1K OHM	J	1/4W
	R1353	ERD25FJ102K	C	1K OHM	J	1/4W
	R1354	ERD25FJ102K	C	1K OHM	J	1/4W

OTHERS

TJE81110	TERMINAL
TMM85521-1	MARK BAND(1)
TMM85521-2	MARK BAND(2)
TMM85521-3	MARK BAND(3)
TMM85521-4	MARK BAND(4)
TMM85521-5	MARK BAND(5)
TMM85521-6	MARK BAND(6)
TMM85521-7	MARK BAND(7)
TQF85280	FUSE LABEL
TUX80701-2	CORD BRACKET (BIG)
TUX80971	CORD BRACKET
TUX85452	IF BRACKET
TXAJTE3P908	3P CONNECTOR ASSY
XTB4+8C	SCREW
XTV3+12A	SCREW

	Ref.No.	Part No.	Description
		XTV3+6A	SCREW
		XTV3+8C	SCREW
		XWG3F10	WASHER
	AC1	TJE80301	TERMINAL
	AC2	TJE80301	TERMINAL
	B1	TJS848100	SOCKET
	B2	TJS848100	SOCKET
	B-	TWH892040	CABLE
	BA-	TWH892038	CABLE
⚠	CRT	TJS828620	CRT SOCKET
	F1	TEL302-9	TERMINAL
	F2	TEL302-9	TERMINAL
	F11	TJS878202	2P SOCKET
	F12	TJS878203	3P SOCKET
⚠	F801	XBA2C25TROA	FUSE
	G1	TJS848100	SOCKET
	G2	TJS848100	SOCKET
	G-	TWH892040	CABLE
	GA-	TWH892038	CABLE
	I-	TWH892038	CABLE
	IA	TJS848100	SOCKET
	J600A	TJS868480	8P SOCKET
	J600B	TJS868580	8P SOCKET
	JS802	TJC3316	FUSE HOLDER
	JS803	TJC3316	FUSE HOLDER
	R-	TWH892040	CABLE
	RA-	TWH892038	CABLE
	R1	TJS848100	SOCKET
	R2	TJS848100	SOCKET
	S651	TAGDSP301NF	SPARK GAP
	S652	TAGDSP301NF	SPARK GAP
	S653	TAGDSP301NF	SPARK GAP
	S654	TVL407	SPARK GAP